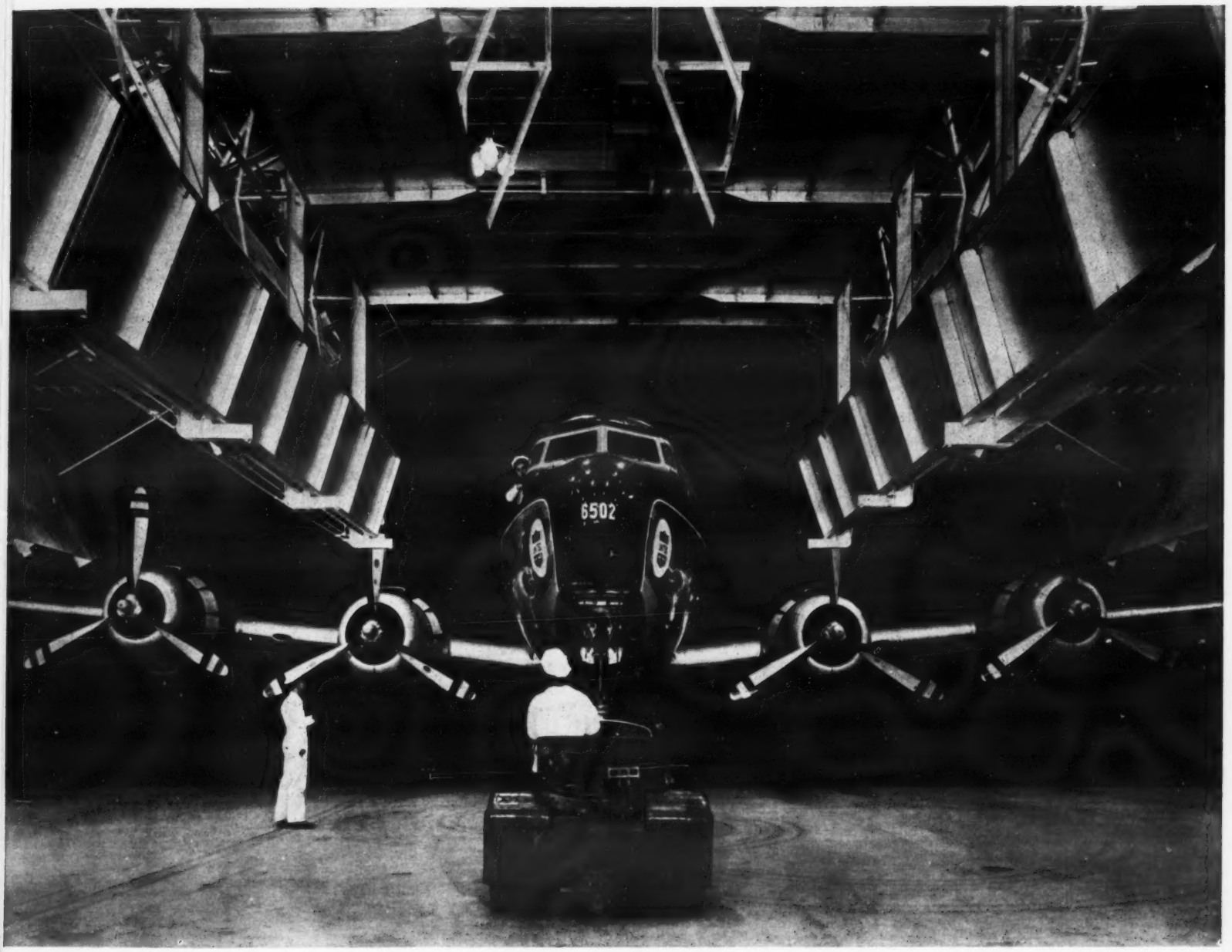
INTER AVIA

Review of World Aviation



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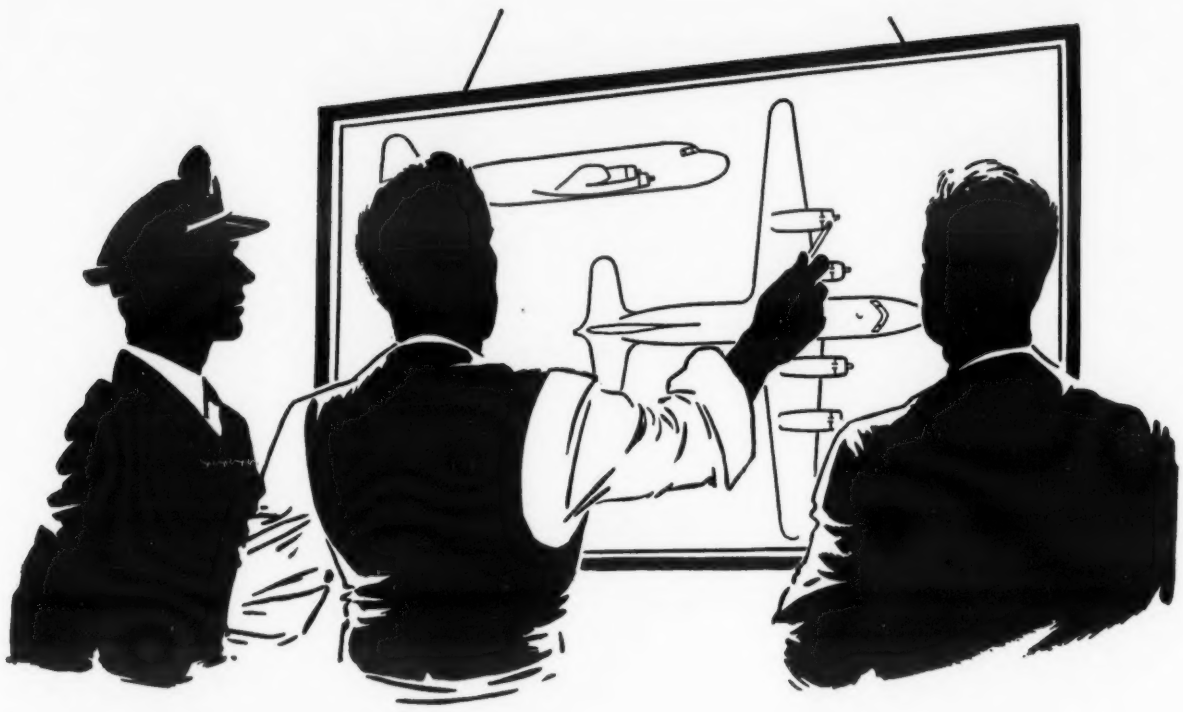
KLOTEN INTERCONTINENTAL AIRPORT, ZURICH

Ed. Amstutz : The Expansion of Swiss Airports
Traffic Control — Radio Installations — Lighting — Constructions

Gilbert Périer : Sabena's Quarter Century
NACA : The Installations for U.S. Aeronautical Research (II)
De Havilland "Vampire" — Modern Personal Aircraft — Overhauling Airliners
The Month in Review

VOLUME III No 6 JUNE, 1948



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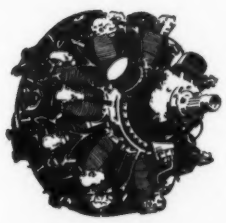

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Review of World Aviation

OFFICIAL ORGAN OF THE FÉDÉRATION AÉRONAUTIQUE INTERNATIONALE (F. A. I.)

Volume III — June, 1948 — No. 6

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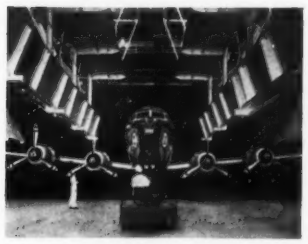

Cover page :

A DC-6 in UAL's new "push button" dock (cf. pages 308-310)

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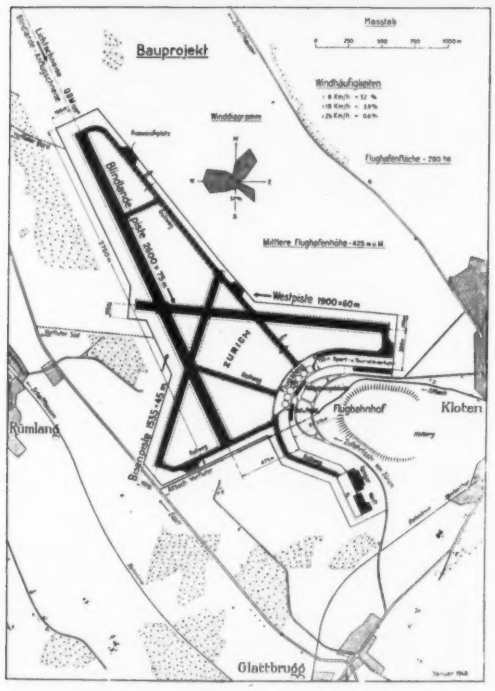

Inauguration of west runway on June 14th, 1948 of instrument runway in October, 1948

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The new hangar at Cointrin Airport, Geneva, is approaching completion

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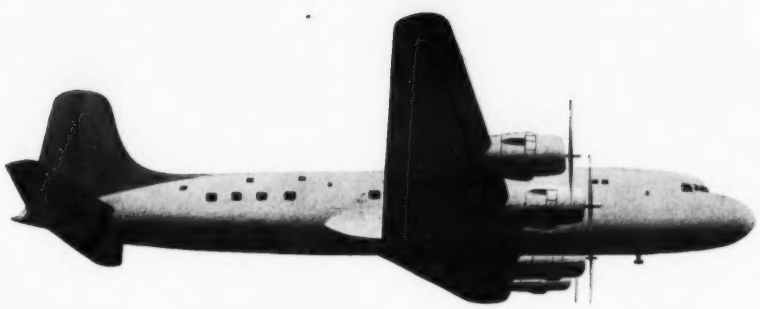

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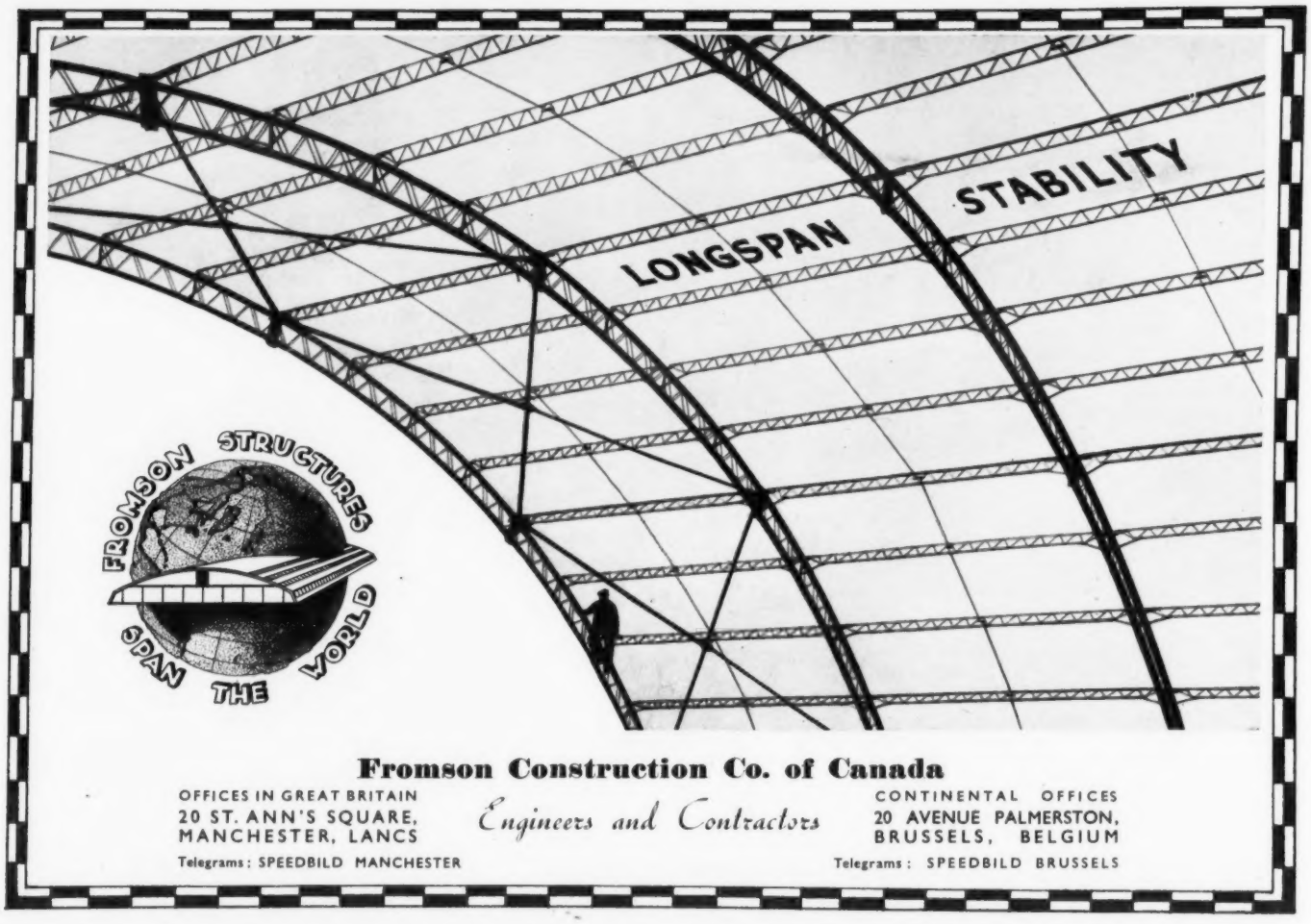

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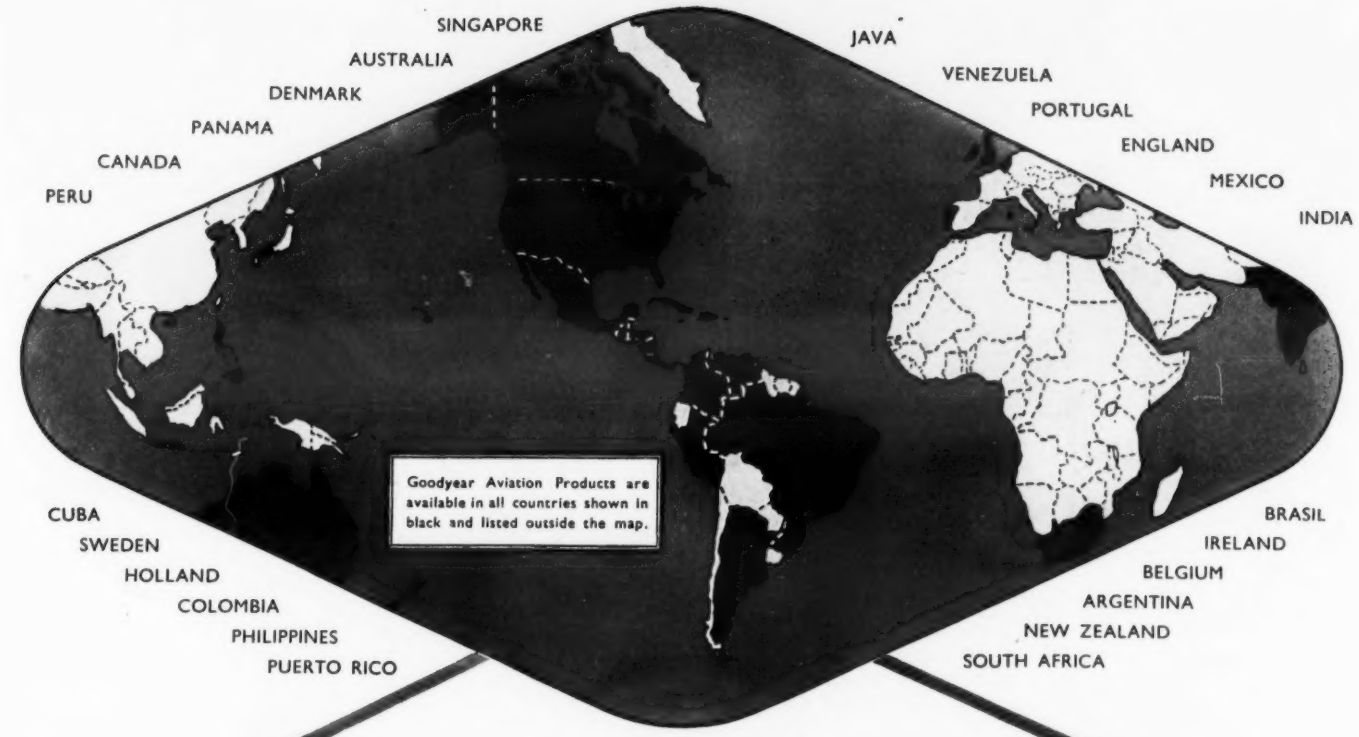

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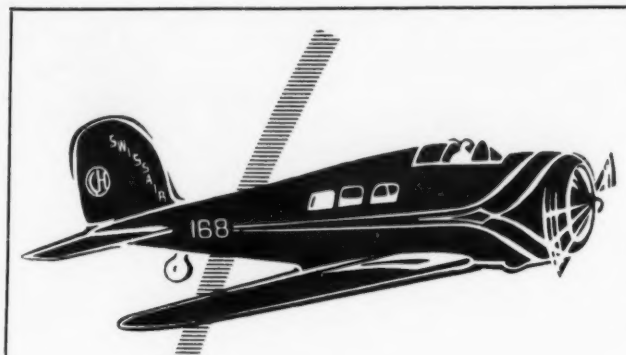

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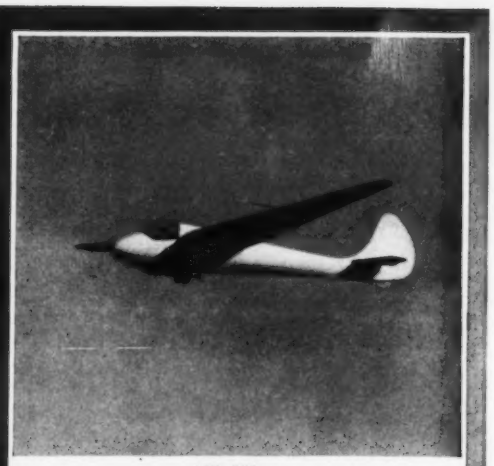

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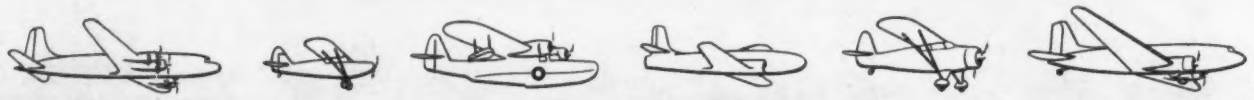

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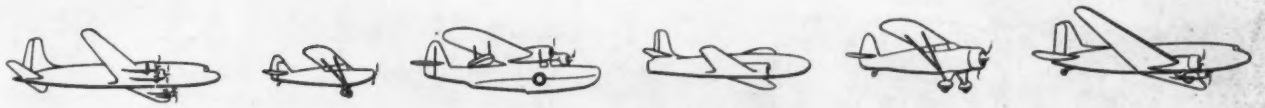

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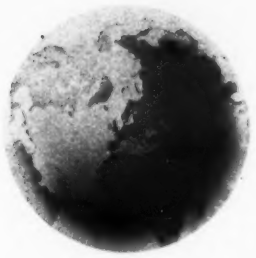


10th May, 1948

Veto !

The Second Assembly of ICAO in Geneva.

Excerpts from the inaugural address of June 1st, 1948, by the delegate from "Ophir" :

"Mr. President, Mr. Chairman, Ladies and Gentlemen.

On the first day of this Second Assembly of our world organisation for civil aviation, may I recall to mind certain words pronounced by our President on the occasion of the First Assembly in Montreal, on May 7th, 1947, with regard to the work of the technical divisions of ICAO :

> *... If ICAO is unable to bring [new procedures] quickly to final enactment, they will be introduced in disregard of ICAO, and the advantages of action through an international organisation will be sacrificed.*

Not a single one of us will question the wisdom of these words. Meanwhile, they are not only valid for the technical divisions, but may be applied to every aspect of our work and aims. Have we acted, or have we been able to act, in accordance with this statement since December, 1944, when we convened for the first time in Chicago for the purpose of concluding a provisional international civil aviation agreement, and thus to lay the cornerstone of ICAO ?

I cannot deny that I am proud to have contributed my share towards the achievements of this organisation, which has certainly done useful work in a number of technical domains. But a question is gradually looming up before us, and not only before us personally, but before all connected with civil aviation—from the executive down to the last ground crew member—and finally also to the public : what revolutionary contribution has ICAO so far been able to make to promote and further the air services which today span the world ?

Since we left Chicago in December, 1944—where the first postwar aviation discussions were held, representing for many countries a first experience of this sort—much has been proposed, much has been promised, and still more has been written. It was at that time we conceived the Five Freedoms, it was at that time we promised their introduction throughout the world. Where are they ? It is not that I am particularly keen on raking up the small mishap we suffered in November of last year, in this very building, when our conference, called for this purpose, ran on the rocks. For my part, I have not abandoned all hopes...

But how do things stand otherwise ?

None of us should forget that, already in December of 1944, in Chicago, we suffered a defeat which should have given us food for thought, but from which it seems that neither we nor international politics has learned anything.

I am referring to that cold and almost disdainful refusal which a large state accorded us when we offered her—at that time with the utmost sincerity—our hand and asked her to take a seat at our conference table in order, all at the same level, to forge the destiny of international civil aviation. In 1945 and 1946, we repeated this invitation from Montreal, the headquarters of our organisation. But our call went unheeded : Russia failed to appear.

I wish to make it quite clear that, in my opinion, in May of 1947, on the occasion of our last meeting, representing the First Assembly of ICAO, we committed the biggest blunder that could ever be committed. Who or what, indeed, compelled ICAO—which was on the right road from the technical standpoint and, politically, because it courted the Soviet Union, had received an icy cold shower—to bind itself, of its own free will, to political concepts ? There might have been some sense in it if only there had been but a spark of hope that a linking of ICAO with the United Nations Organisation—and consequently its branding as a political instrument—could have evoked a more congenial attitude on the part of the Soviet Union.

However, we chose this way and, true to the present status of UNO, we requested one of our members, Spain, to leave the conference hall. Whether I am in favour of Franco, the Pretender to the Spanish throne, or the Spanish Leftists, seems to me to be of no importance. Aircraft of my country flew to Spain and shall continue to fly there ; they were permitted to fly over Spain and shall continue to do so. In consequence, it seems to me to be only right and fair that my country should grant reciprocal rights to Spanish aircraft. In this respect, my thoughts are entirely apolitical, and are concerned purely with the traffic, technical and—if you wish—legal aspects of aviation. And again, whether I am for or against the Communist system, it seems to me, as a man concerned with international civil aviation, that if Russian airline companies wished to work on an equal basis with my country, then I could ask nothing better. As far as I am concerned, they are welcome at all times.

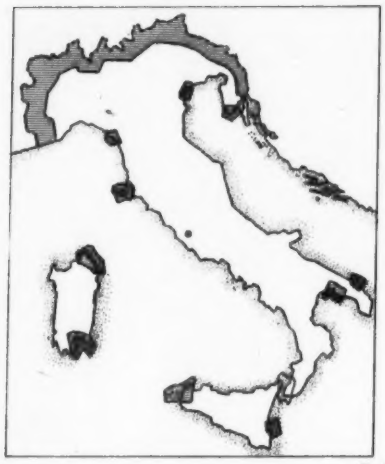
No, in this respect our last assembly in Montreal did not take place under a very lucky star. We indulged in politics, though we had no need to do so ; and our politics were not good. I must say that I feel rather uneasy when I recall the words and the attitude with which the Spanish delegate left us in Montreal. We ousted him from this organisation, we submitted to UNO's wishes, and we pronounced our first "veto."

In order to show you how far the term "veto" can lead, I shall ask you to imagine four pictures successively projected on to a screen.

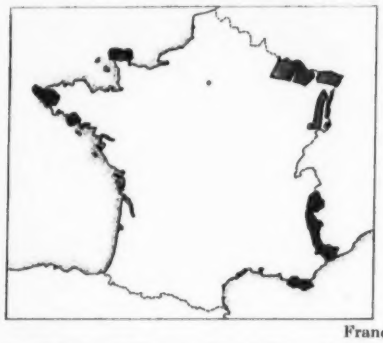
You will probably recall that the first flight over the English Channel, by Louis Blériot in 1909, demonstrated very clearly to the nations how easy it was to cross national frontiers with the aeroplane. The result was that, already in 1910, we began to concern ourselves, theoretically, with the problem of forbidden zones, although at that time—that happy time of peace—we didn't establish any general regulations. You have perhaps forgotten, on the other hand, that as early as in 1913 the "neighbourly" relations between France and Germany led to the establishment of forbidden zones and, consequently, to certain narrow air corridors between both countries. But you will certainly all recall that the Paris Agreement of 1919—in which ICAN directly laid the foundations for the present Chicago Agreement—referred in Article 3 to the problem of forbidden zones and thus to air corridors, thereby creating a fair number of obstacles to civil aviation. And Article 9 of our Chicago Agreement did not incorporate any useful changes.

And now I shall show you the picture in diapositive.

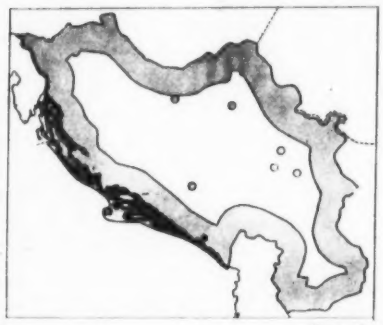
I want you to look first at the Italian, second the French, and third the Yugoslav forbidden zones, as they existed between 1920 and 1939, at least on paper or on maps. The object of these forbidden zones was to prevent people from taking a look at military installations. But everybody knows that precisely these three countries, which believed themselves to be so hermetically protected, were quickly overrun by the invader. The "miniature iron curtains" were not of very much use. With or without transit flight authorisation, the



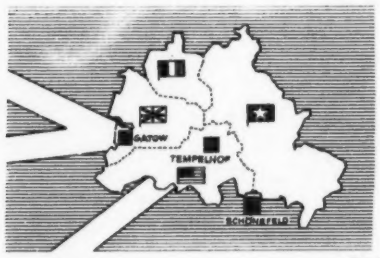
Italy



France



Yugoslavia



Berlin

enemy's archives contained information on all their cartographic secrets, which were really no longer secrets.

What, therefore, did these forbidden zones really represent ? They, too, constituted a "veto," inasmuch as they were an obstacle to civil aviation. Just recall that technically rather backward epoch, and picture what it meant if a commercial transport aircraft was unfortunate enough to deviate from its course, owing to weather or to technical reasons, and fly beyond the limits of a narrow air corridor. This led to a diplomatic incident, an exchange of Notes between Foreign Ministries. When you look back upon it, was it not laughable, old-fashioned, and even scandalous ?

And, since we are now talking of forbidden zones and air corridors, I will complete my series of pictures with the fourth one. This picture does not originate from a grey, pre-war era, nor from the period of hostilities. It originates from the year 1948, thus from the era of ICAO. It portrays the forbidden zone of Berlin and those three tiny corridors which, at least until the present, have remained open to aircraft of the Western Allies flying towards the shattered city. We all know that this forbidden zone of Berlin was the scene of a regrettable incident last April, when a British transport aircraft and a Russian fighter collided in mid-air. You know, moreover, that it still remains for both sides to decide upon whether the British or the Russian pilot should be blamed for the crash.

As a delegate to the Second Assembly of ICAO, I have no hesitation in exonerating the dead Russian and the dead Britisher from all blame. Both asked for nothing better than to live. The blame for this death of fifteen persons lies, in my opinion, in the term "forbidden," in the concept of obstacles in the air space, and thus directly in the failure of our efforts hitherto.

Gentlemen, I would ask for a moment's silence while you stand and remember these dead... The only way in which you can make up for this tragedy is, if this time, you begin your work under the motto "Freedom of the Air."

There can be no such thing as a veto in the air space. Icarus did not fail owing to an obstacle in the air space, but because his ideas were technically imperfect. It is our present belief that we have brought about technical improvements, and we hope that, on the basis of our work, we shall gradually bring them near to perfection.

However, what is the use of all this if, by our own old-fashioned politics, we render our creations sterile ? *EEH.*

Where's TWA Heading ?

LaMotte T. Cohu, who was appointed President of Transcontinental & Western Air, Inc., only a year ago, and who has always been respected throughout U. S. aviation circles, surprised the public on May 2nd by announcing his resignation for as early as June 1st. The reason for this step, he says, is that he has "achieved the purpose of his office" : the strengthening of TWA's financial position.

However, it was only a few hours later that a hitherto undenied report stated that TWA, one of the leading domestic and overseas U. S. carriers, was heading for a new financial crisis : the general fund cash balance has fallen so low as to be insufficient for covering expenses over a thirty-day period, the banks seem reluctant to help, and the CAB has so far not complied with TWA's appeal for emergency relief under a retroactive mail rate adjustment.

It is not TWA's first crisis of this kind. A little over a year ago, on February 21st, 1947, the public was equally surprised to hear of the resignation of Jack Frye, President and founder of the airline, along with several other high TWA executives. One might ask whether Jack Frye did not introduce a "Trojan Horse" into the TWA Board, in the person of his friend and main shareholder, Howard Hughes. At that time Howard Hughes mastered the company's financial crisis. But this young and utterly fearless industrialist has always been the object of much controversy. It became an open secret that the government authorities and a number of banking concerns would have preferred to see him leave TWA altogether. Nevertheless, he refused to be daunted.

Will he be able to hold his own this time ? Just lately his name has been mentioned far too frequently by Congress, investigation committees and in connection with various court proceedings. There is really no clear indication yet as to how TWA will find the millions for its depleted cash account and who will be the new President.

This news brings again to the surface certain rumours which were circulating quite some time ago, namely that perhaps the only way for TWA to achieve a really healthy status is by amalgamation with one of the other big carriers—Pan American World Airways, or American Airlines System. The latter concern, meanwhile, seems an unlikely taker for the present, since its ready cash situation is by no means too bright either.

But what about Pan American ? Although the carrier's President, Juan T. Trippe, has not been in the news so much lately, he is still America's No. 1 air transport wizard. As everybody knows, he has long fought for the right to fly domestic routes—to be on a par with his competitors. He would achieve this if he took over TWA. Despite a long struggle, he has so far not received the CAB's permission to fly to Paris and Rome. But a merger with TWA would give him this right automatically. He has long advocated a single all-American flag carrier for overseas operations. A fusion with TWA would bring him very near to this goal.

Juan T. Trippe has the confidence of the U. S. public and the banking concerns, as well as of the CAB and the aircraft industry. If he can carry this deal through successfully, then he will be able to economise, and will head the world's mightiest airline concern.

It is only a possibility today—but it could be a reality tomorrow. *EEH.*

Sabena's headquarters in Brussels.

Sabena's Quarter Century

Twenty-five years ago, on 23rd May, 1923, the national Belgian airline company was founded under the name of Société Anonyme Belge d'Exploitation de la Navigation Aérienne, better known today as SABENA.

Although Mr. Gilbert Périer, President and Managing Director of this concern, exhibits justifiable pride in his review of the company's rise to an undertaking of world importance, his anniversary message all the same features a noteworthy characteristic : rather than celebrate laurels, he remains critical. And indeed, when we look upon the poor progress which our generation has so far made to further the international status of civil aviation, there is a strong call for criticism.

But we can still say—Well done, SABENA.

The Editor.

President and Managing Director of Sabena, Mr. G. Périer who has been elected President of IATA for 1948. He is shown here together with the Association's Director-General, Sir William P. Hildred, in Montreal.

Twenty-five years for an airline company, as for a human being, means that the age of adolescence is barely over. As befits its aims, our young profession has progressed at such a rate that our elders have not had time to grow old and have hardly begun to grey at the temples. But, viewed from another angle, aviation has covered so much ground that we tend to look back upon 1923 as the crusading days.

Yes, we must admit that 1923 was a prehistoric year from the aeronautical point of view. Our aircraft, strain as they might, could hardly make headway against the air currents, and we flew through rain and hail like soldiers advance through storms of bullets—by carefully avoiding them.

It was during this prehistoric period that a number of Belgians named Marchal, Nélis, Renard, Cornélius and Orta founded Sabena, which took its roots in the foundation prepared since 1919 by SNETA (Société Nationale pour l'Etude des Transports Aériens). It was in 1919, thus nearly thirty years ago, that the first Belgian air routes were established ; not only in Europe, but also in Africa where, based at Leopoldville, small military seaplanes flew scheduled air services along the Congo River. In homage to a very far-seeing sovereign, this air service bore the name of "Ligne Aérienne Roi Albert."

Six years later, in 1925, Edmond Thieffry, a Belgian ace pilot of World War I, forged the first aerial link between Belgium and the Congo—a link which was not to become a regular service until ten years later.

* * *

The period between the two wars was devoted to the early upbringing of commercial aviation ; and, at least as regards Europe, it did not come of age until the time of the liberation.

Every European company can spin a few interesting yarns about the decades between 1920 and 1940, and there is an odd resemblance among all these stories. As a rule, the airlines progressed step by step, at a rate depending on how quickly the few new commercial transport aircraft could be put into service. Flying equipment, workshops, flight and ground personnel all grew up together.

In those days there was no talk of third, fourth or fifth freedoms. As a matter of fact, we enjoyed all those freedoms long ago, and the majority of us even indulged in cabotage with neighbouring states. The International Air Traffic Association, founded at the Hague, was like a small-scale version of the present International Air Transport Association, born twenty years later in Havana. ICAN was not much different from ICAO, just as the Euro-

Sabena hangars.

pean headquarters of UNO in Geneva still has the name "League of Nations" written on the gates.

But it would still be wrong to say that there is nothing new under the sun. There is, in fact, something startlingly new ; something which has revolutionised everyday life, and not only from the aeronautical viewpoint. There is no longer an Atlantic Ocean. There are no longer any physical obstacles marring the unity of the air space. The skies have now been opened for all to move freely, making countless benefits available to mankind if it were not for obstacles of a juridical nature which continue to arise out of numerous, and mostly futile, concepts of national sovereignty.

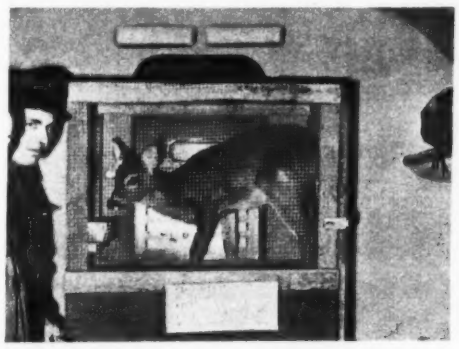
To put it briefly, what have we achieved in twenty-five years of commercial aviation ?

I can speak only for Sabena. But I would be surprised if our story did not apply equally well to the airline companies of other countries.

The progress achieved by us is considerable, but it is still insufficient. It is considerable from the standpoint of flying equipment, thus as regards performance, comfort, payload, safety, maintenance efficiency, and commercial returns. And this definite and constant progress is thanks to the undreamed-of increase in traffic demand, which we have illustrated here by reducing it to the natural common denominator of the tonne-kilometre :

TONNE-KILOMETRES FLOWN BY SABENA

Year	European Division	Belgian Congo Division	Belgium-Congo Division	Intercontinental Division	Total
1924	32,000	—	—	—	32,000
1925	84,000	18,000	—	—	102,000
1926	81,000	51,000	—	—	132,000
1927	63,000	82,000	—	—	145,000
1928	120,000	130,000	—	—	250,000
1929	157,000	116,000	—	—	273,000
1930	296,000	151,000	—	—	447,000
1931	368,000	148,000	—	—	516,000
1932	366,000	105,000	—	—	471,000
1933	472,000	117,000	—	—	589,000
1934	513,000	135,000	—	—	648,000
1935	802,000	137,000	79,000	—	1,018,000
1936	1,086,000	105,000	250,000	—	1,441,000
1937	1,309,000	104,000	396,000	—	1,809,000
1938	1,985,000	165,000	495,000	—	2,645,000
1939	1,314,000	200,000	525,000	—	2,039,000
1940	129,000	555,000	307,000	—	991,000
1941	—	1,588,000	—	—	1,588,000
1942	—	2,424,000	—	—	2,424,000
1943	—	3,123,000	—	—	3,123,000
1944	—	3,316,000	—	—	3,316,000
1945	110,000	2,586,000	1,143,000	—	3,839,000
1946	4,055,000	3,367,000	8,332,000	186,000	15,940,000
1947	8,188,000	3,237,000	10,318,000	2,766,000	24,509,000



You're never too young to fly !
Fauns cross the Herring Pond in a DC-6. A baby gets cured of whooping cough.

"Shooting the sun" through the astradome.

A Sabena airport-to-city coach.

But there's a cloudy outside to every silver lining ! And as regards our case we are forced to admit that, in the fields of international rights and ground organisation, commercial aviation has not progressed as it might have done. With respect to aviation's international status, I am not even sure whether we can say that any progress at all has been realised since before the war. Certain sovereign countries —and not only those on the other side of the "Iron Curtain"—are not yet willing to grant the most elementary freedom of the air, namely the freedom to fly peacefully over their national territory. Others negociate for their interests by way of bilateral agreements; and the flag of multilateralism, to which the air powers so eagerly pledged allegiance in Chicago as recently as 1944, is nothing more than a historical bit of rag today. It's no use fooling ourselves. As long as there is no world sovereign authority which can dictate terms to international politics, things won't get any better.

As regards ground organisation, however, we have every right to be a lot more optimistic. The exemplary work accomplished by the various committees of ICAO and IATA has already led to unification in more than one field, and to great improvements as regards safety. We may rest assured this work will bear fruit as soon as the international political situation enables science to be demobilised a little more completely.

Thus the desire in the hearts of Sabena's leaders, at the moment when this company is crossing the threshold of its second quarter century, conforms to the universal desire for peace.

There is no doubt that, in a world of peace, and under the aegis of adequate international organisation, commercial aviation can and must fulfil an exceptional mission of bringing the peoples of the world closer together. It is also certain that, only under such conditions of world order, will we be able to solve the cardinal problem of safety in the air.

Gilbert Perier,
President and Managing Director,
SABENA.

馬空

TIMETABLES.

(Times in Malayan Time GMT + 7 hours 30)

		Daily	Tues. Sat.
Singapore	dep	0800	1600
Kuala Lumpur	—	0930	1735
Ipoh	—	1035	
Penang	arr	1130	
Penang	dep	1500	
Ipoh	—	1545	Tues. Sat.
Kuala Lumpur	—	1645	0800
Singapore	arr	1830	0935

		Mon. Thurs.
Kuala Lumpur	dep	1000
Kota Bharu	arr	1145
Kota Bharu	dep	1215
Kuala Lumpur	arr	1400

		Wednesdays.
Kuala Lumpur	dep	1000
Kuantan	arr	1115
Kuantan	dep	1145
Kuala Lumpur	arr	1300

		Saturdays.
Singapore	dep	0730
Medan	arr	1010
Medan	dep	1600
Singapore	arr	1835

Times published in this table are the latest times passengers may arrive at the terminal building to catch the aircraft. The times shown for intermediate stations are also the approximate arrival times of the aircraft at those stations.

All schedules and times are subject to alteration at the Company's or Captain's discretion. Connections cannot be guaranteed nor can liability be accepted for delays.

Cars. If you want a car ordered to meet you at the airport on arrival, please inform the booking clerk when you buy your ticket.

Fares must be paid in cash at the time of booking. Reservations for which fares have not been paid 24 hours before departure will be regarded as cancelled.

◁時間表▷

(馬來亞時間 倫敦標准 時間加七小時三十分)

		每日	星期二及六
星	加 坡	開	〇八〇〇	一六〇〇
吉	隆 坡	一	〇九三〇	一七三五
怡	保	一	一〇三五	
檳	城	到	一一三〇	
檳	城	開	一五〇〇	
怡	保	一	一五四五	星期二及六
吉	隆 坡	一	一六四五	〇八〇〇
星	加 坡	到	一八三〇	〇九三五

		星期一及四
吉	隆 坡	開	一〇〇〇
瓜	拉	到	一一四五
瓜	拉	開	一二一五
吉	隆 坡	到	一四〇〇

		星期三
吉	隆 坡	開	一〇〇〇
關	丹	到	一一一五
關	丹	開	一一四五
吉	隆 坡	到	一三〇〇

		星期六
新	加 坡	開	〇七三〇
麻	坡	到	一〇一〇
麻	坡	開	一六〇〇
新	加 坡	到	一八三五

上述時間表公佈之時間，乃搭客須到達終端搭機之最後時間，至於各中站之時間乃最後開機經各站之大概時間。

一切定機安息時間，可隨時依據易司或機長之所示予以更改，關於乘客之職務，公司不能保証其一定按期，亦不能接受延誤之責任。

通票——搭客欲購票者，須於廿四小時內通知搭機所抵城市之定票處，如是可于如期前十小時購票為是。

汽車——如搭客於飛機降落地點時需用汽車者，請於購票時預先通知定票處之職員

訂購票時須以現款付票價，如定票處於飛機得抗之前四小時仍未付票價者，將其客票取消。

pilots were a legendary people of a fabulous kingdom called Ki Kouang. They only had one arm, but three eyes to make up for it; and they travelled in flying chariots. The writing on the left of the accompanying picture means "stories of mountains and seas," and that on the right :

> "This being has one arm and three eyes. It is both feminine and masculine, and is able to build flying cars going with the wind in the north of the Land of One Arm."

Meanwhile, if you find these "windships" tax your powers of imagination too much for you to speak of heavier-than-aircraft, then you only need take the trouble to page through

oriental history until you come to the end of the Han dynasty, where we step out of the dark ages of pure fable and into the light-dark era of semi-historic tales. Chu Kai Lian, Minister in the House of the Emperor, waged war against Wei on behalf of Han and Wu. And because the province of Wei was very well armed, Chu Kai went into battle with wooden oxen and wooden houses—robots which, impervious to arrows, penetrated into the enemy's territory. And, best of all, he built a *flying car,* from which he bombarded the unfortunate inhabitants of Wei to such an extent that he settled their hash for good.

You might ask whether this is a fable or a true story. Since no construction plans or precise data are available, it is perhaps better if we call it a pure fable. But there's no getting away from the fact that, in two or three thousand years, people might look upon our own present-day history as a mass of fables.

* * *

Seventy years ago, Malaya was a jungle. But today, Malayan Airways are anxious to tell the world that Malaya is the best little bit of Asia, and that Malaya is very modern.

The new airline company is not yet on the roster of the International Air Transport Association, whose official languages are temporarily only English, French and Spanish. But you never can tell. As we all know, ICAO has become a part of UNO, and the latter world organisation—probably to the consternation of its translation staff—has agreed to have Chinese as an official language at its conferences.

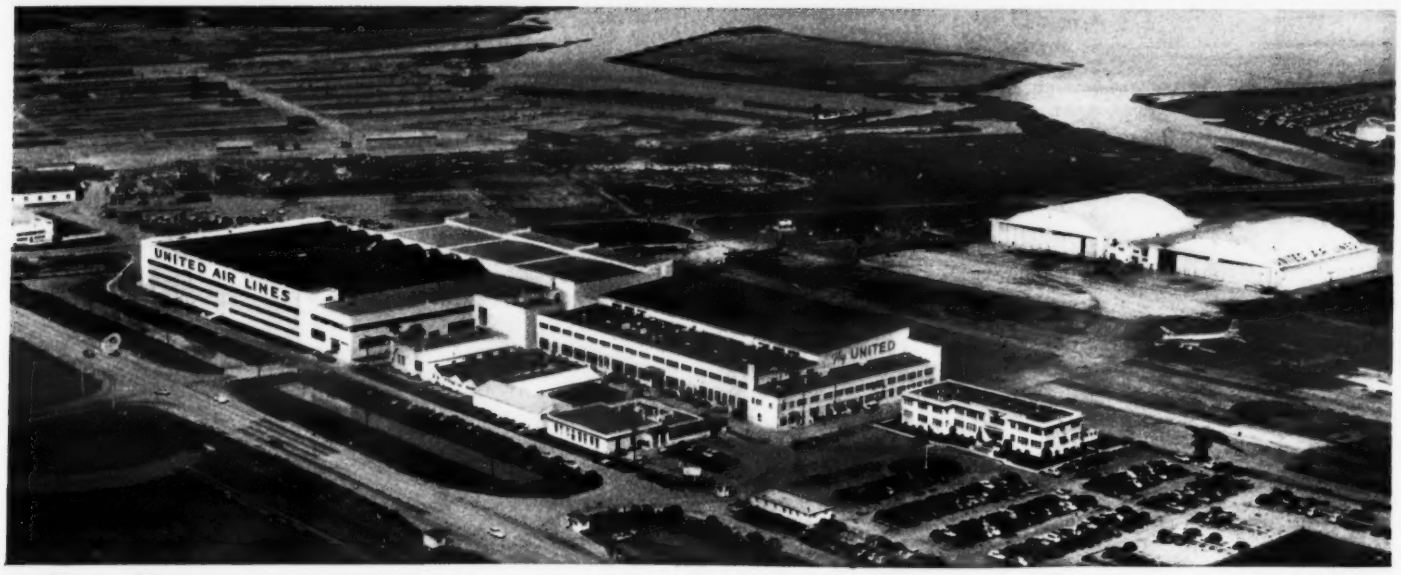
The letterhead bears a New York address, conjuring up pictures of bobby-soxs, sky-scrapers and chewing gum. The letter informs that Malayan Airways Limited of Penang are represented in the U.S.A. by Air Carrier Service Corporation. Accompanying the letter is something which bears the heading "Timetables," but which is considerably more decorative than informative. For all we know, it might just as well be a lyric by Li Tai Po.

Of course, you can't get away from the fact that Chinese, written as it is, vertically, is the ideal timetable language. However, you may be gratified to learn that 上述時間表公佈之時間 only means : " Times published in this table are the latest times passengers may arrive at the terminal building to catch the aircraft." Incidentally, you may have noticed something odd here. Americans and Europeans would say, "The aircraft takes off at such and such a time." However, the concepts of time are more elastic in the Far East. Orientals don't like to make things too definite—and this isn't a bad idea either, as you'll readily agree if you've experienced how exactly the airlines adhere to indicated times of departure.

In reality, it is not at all surprising that the timetable is written in Chinese. Of the five million inhabitants of Malaya, almost half are Chinese. And with regard to the passengers, well, about 70 to 80 per cent. of the money in Malaya is probably banked in the names of Chinese. Lastly, and very much by no means least, the Chinese were airminded over 2,000 years ago.

We're not talking here about heraldic emblems in the form of flying dragons. No Chinese ever connects these with the idea of real flying. It so happens that the symbolic dragon doesn't fly, but is supported by the clouds. That is why the silk tapestries featuring dragons never show a clear sky. The clouds which surround the motif are in reality a very necessary commodity.

It is therefore not with dragons that we are concerned, but real heavier-than-air flying machines. In the Chan Mai King, the Book of Mountains and Seas, which was a best-seller 2,000 years ago, the aeroplane plays a pretty weighty part. Its constructors and



UAL'S VAST MAINTENANCE HUB, San Francisco, covering 116 acres at the Municipal Airport. At the left edge of the photo are the new carburettor and engine test cells. To their right are the new shop building and three adjoining hangars. Further to the right are the original hangar and shops, and the administration building.

Overhauling

It is understandable that commercial airliners must fly and not stand idle if they are to pay their way. To have them in operation day and night, scarcely landing before they have taken off again, would be the ideal of the profit-conscious operator. Too good to be true, however, for besides a thorough check at every stop, more exhaustive and time-losing checks are performed between every 25 and 45 hours of flying, before completion of 80 hours, and before completion of every 150 hours, in order to keep plane, engine and instruments in fit condition to offer utmost passenger safety. After every 700 to 1,000 hours—virtually every quarter year—airliners come into the base for a thorough overhaul. This means that engines and instruments are taken apart, seats, carpets, etc., go to the upholsterer, and every single item is given an exhaustive check. Since the airliner has to stand idle during this period, which sometimes extends over many days, the owner loses money. It is therefore understandable that he does his best to shorten the procedure.

The urgency of quick overhauling is illustrated by the new maintenance base of United Air Lines in San Francisco : an ultra-modern, two-and-a-half storey structure with a full frontage of 650 feet. Attached to it are three 130×130 foot hangars, each large enough to house a Boeing "Stratocruiser." On the first floor of the main building is the large, brightly-lit workshop for engine overhaul, with an engine parts stockroom and a machine shop ; next to it are the much smaller frame overhaul shop and a sheet metal shop. The second floor is still more brightly illuminated, with sawtooth roof bents admitting large quantities of light. On this floor are the shops for overhauling accessories and instruments—with dust-free, artificial ventilation under slight pressure —radio equipment and cabin fittings, as well as the usual stockrooms and offices. In an adjoining building are six engine test cells and—something new in maintenance—a special cell for testing and regulating carburettors, where pressures corresponding to altitudes of 50,000 feet can be simulated. Apart from these new installations, which were put into operation at the end of last April, the UAL base still comprises the original maintenance facilities. The entire base covers 160 acres, on which there are 700,006 square feet of buildings.

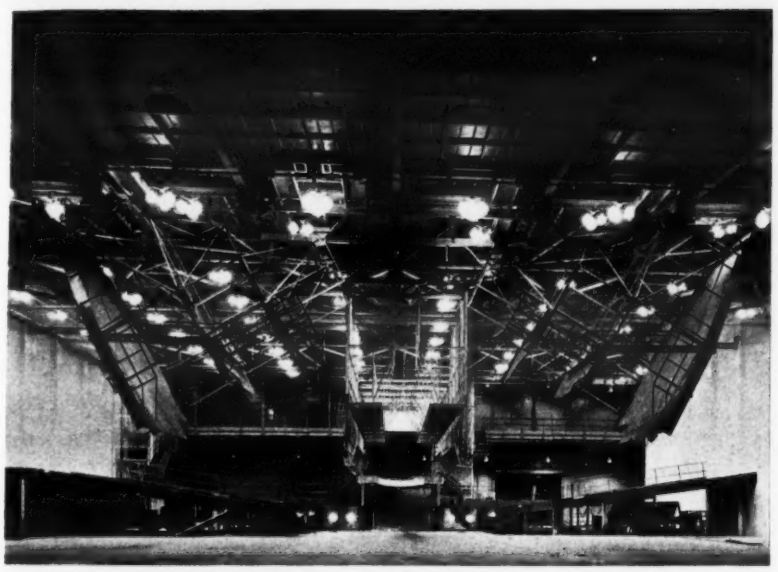
A "NEW" DC-4 will soon emerge from the "old" maintenance shop.

When a "Mainliner 300" (Douglas DC-6) has flown its prescribed 700 hours, it is brought back to San Francisco where the unique "push-button" dock awaits it. This spectacular feature embodies a system of electrically-operated catwalks which completely surround the plane so that the overhaul crew can approach it within minutes instead of hours. The plane is towed in so as to fit snugly into a forward platform on a level with the cockpit floor. Catwalks are lowered from a metal framework on either side of the plane after hydraulic jacks have lifted it several inches off the floor. Next, a giant metal framework comes down from the ceiling to fit closely around the tail assembly. Then a hydraulically-operated ramp comes up from the floor to connect with the long catwalks at the level of the main cabin door.

Within ten minutes from the time the plane has entered the hangar, as many as fifty workers are swarming all over it. Electric-hoist operators prepare to lift the four engines off their mounts even as mechanics are unfastening the connections. Every detachable part is whisked off to the respective workshops. Compressed air, electric current, vacuum, cleaning solvents, lubricating oil, and so forth, are all located at convenient places. Lamps on the floor and the ceiling pour light into every nook and cranny.

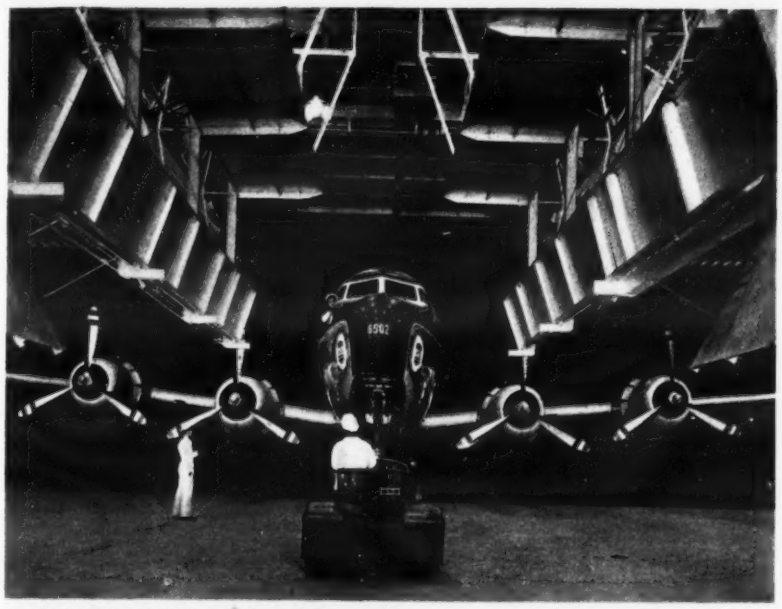
Whilst the surfaces of the fuselage and wing are being cleaned, examined and made like new, the engines are being inspected. But this is not done on the spot either : long before the engines are again ready for service, the aircraft will have left the dock with the engines from a previously overhauled "Mainliner."

When an engine is wheeled into the shop it is given a quick steaming and then disassembled. The large parts are slung, either directly or in metal baskets, from a 1,280-foot-long overhead endless chain conveyer and slowly dragged through a 160-foot-long hairpin-shaped tank

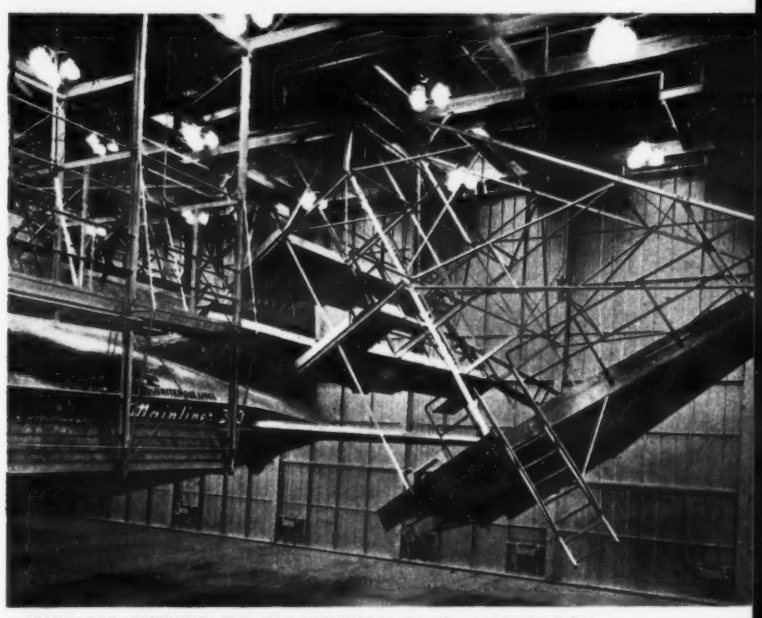


THE " PUSH BUTTON " DOCK, ready for action.

NOW FOR THE TAIL ASSEMBLY. It's still 30 feet high, but one push the button...

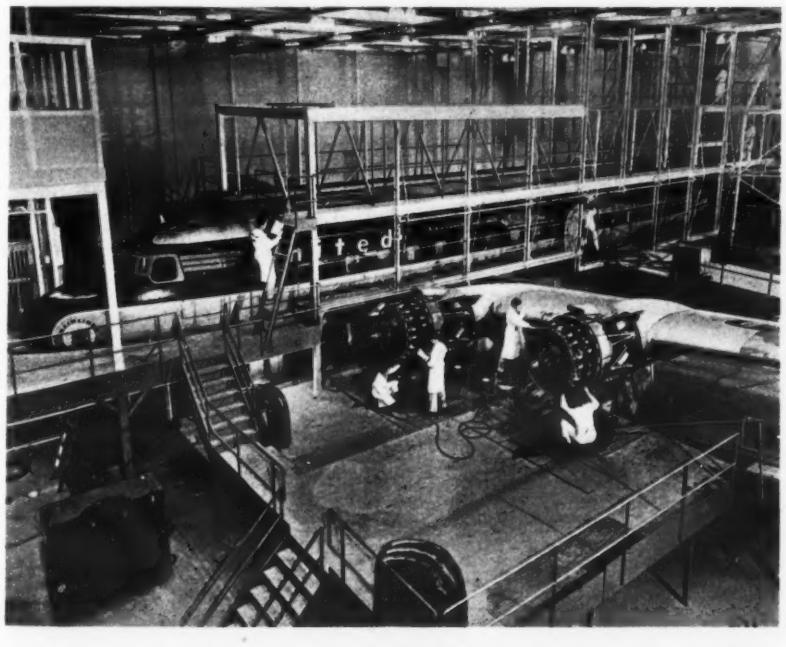


A DC-6 BEING TOWED into the dock by a tractor.

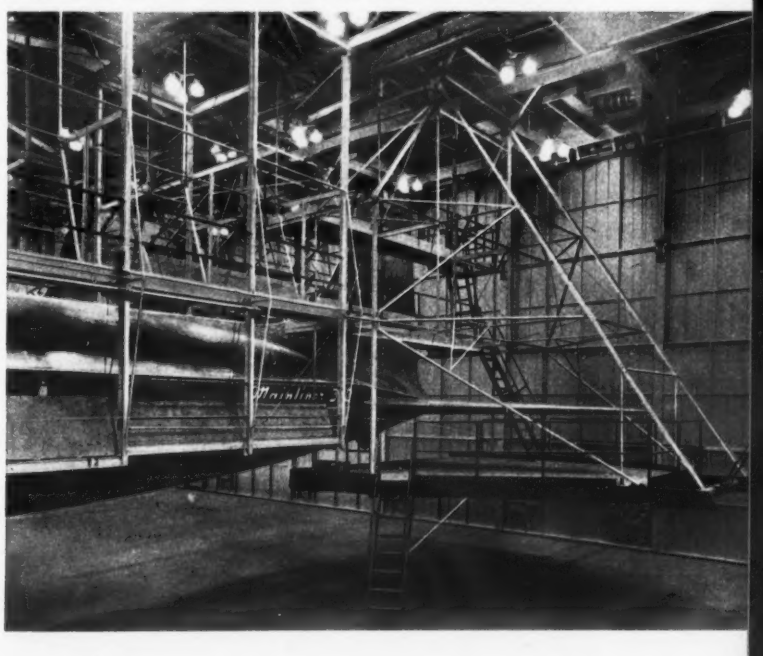


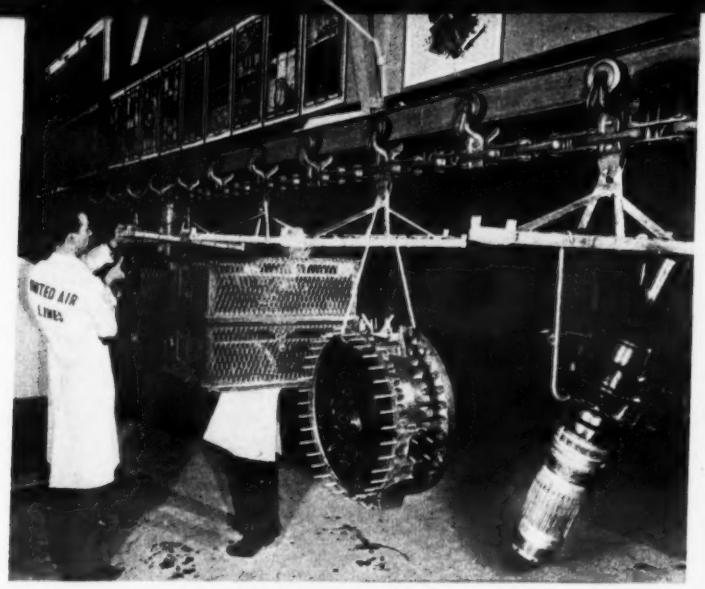
... READY FOR PREENING THE TAIL FEATHERS, the framework is being lowered to fit snugly around the tail section...

AIRLINER IN DOCK. The airscrews have already been removed, and the engines are about to be taken off to another shop.



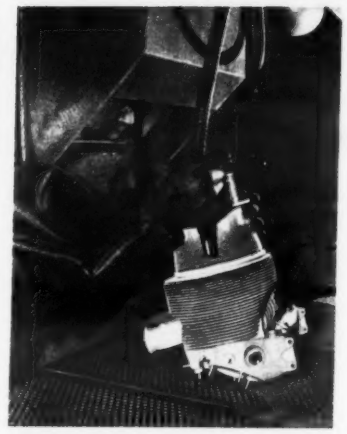
... GRIPPING THE TAIL FROM ALL SIDES, the framework provides three platforms from where the maintenance men can reach every screw and rivet.





"UNWINDING" AN ENGINE. Piece by piece, the engine is hung on to the overhead chain conveyer which moves along at only a few inches a minute.

ENGINE BATH DELUXE. Two by two, engine cylinders enter the 160-foot washer tank, where they will be scrubbed for five hours.



A NEW USE FOR WALNUT SHELLS is to grind them finely and spray them against cylinders under compressed air. It's just as effective, but less abrasive than sand.

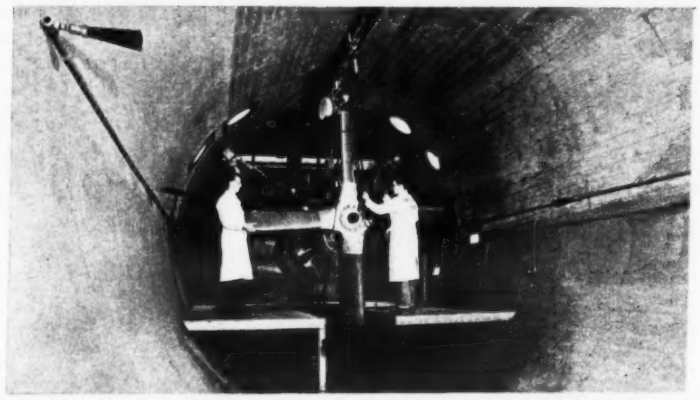
containing 30,000 gallons of a strong detergent, where they are given the most thorough bath imaginable during five hours. After that, they are ready for inspection.

Each part exposed to wear and tear is measured with delicate gauges and micrometers—sometimes to tolerances of 1/10,000th of an inch. Steel parts are put through a Magnaflux process in which metal filings, drawn by powerful electric currents, form a pattern around any flaw, no matter how infinitesimal. Imperfect parts are rectified, or, if this is not possible, replaced. Then another conveyer carries the parts belonging to each engine to another shop for reassembly. However, the "new" engine does not go back into service until it has passed a test run of at least four and a half hours in one of the six engine test cells.

Complete overhaul of an airliner like a DC-6, which terminates with a four-hour trial flight, requires only four days. By the time an engine has been revised and brought to the test cell, twelve days have elapsed.

For the present, the San Francisco base overhauls only four-engined "Mainliners." But UAL plan to transfer DC-3 overhauling from Cheyenne, Wyoming, to San Francisco before the end of this year. In this way they hope to reduce their overhaul personnel from the present 2,500 to 2,000 employees.

The new maintenance base has cost United Air Lines four and a half million dollars, a capital which brings in a two-fold interest—higher ultilisation factors and less labour expenditure—and which will probably be amortised within few years. And the knowledge that one consolidated maintenance base can be relied upon to keep all material in perfect condition is an asset which neither the carrier nor the passenger can express in terms of dollars. 7.

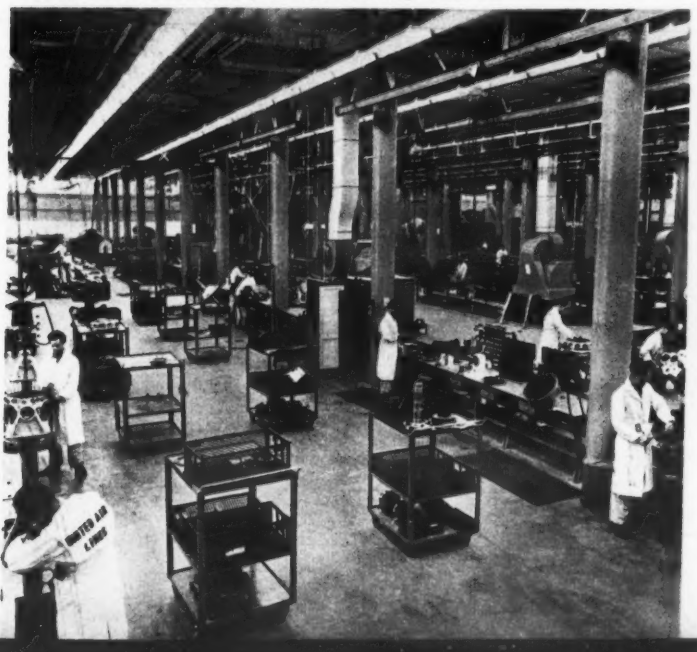


ENGINE "SHAKEDOWN." Each revised engine has to run four and a half hours in one of the six test cells.

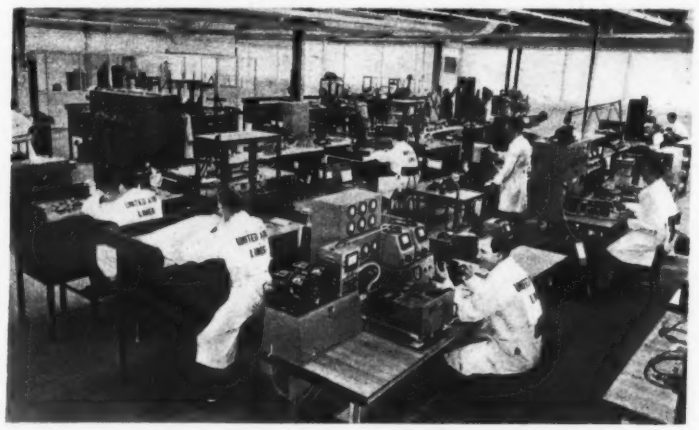
TEST CELL CONTROL ROOM, from where the operator carries out measurements and observes the running engine through a protective window.

CONTROLLING CARBURETTORS IN THE DECOMPRESSION CHAMBER. Pressures up to 50,000 feet altitude can be simulated.

POWER PLANT DEPARTMENT, which gives new engines for old.



DUST-FREE WORKING CONDITIONS for checking and repairing delicate instruments. Air is filtered and kept under slight pressure.



Take it Easy!

It's just as well to be prepared for any eventuality. As I'm thinking of crossing a few oceans by air in the near future, I thought it as well to get hold of a little brochure, charmingly illustrated with humourous drawings, entitled, "Security Measures in the Air." It's purpose is to explain to passengers what they should do in the event of a forced landing.

The book's first care is to stress that, as on board ship, the captain's word is law. It is, of course, quite obvious that if you start arguing about the extent of the captain's right to give orders, or begin discussing whether or not you intend to obey them, you'll be running around in circles and wasting a great deal of precious time at the very moment when the alarm calls for prompt, decisive action. As you'll agree, it's much better if all this sort of thing is absolutely cut and dried before you leave the ground. What does it matter if, for once, no one bothers about democratic principles ?

Then the brochure goes on to explain by which doors one should leave the aircraft, planned according to the seat occupied by the passenger ; and which rubber dinghy must be used.

These rubber dinghies are really wonderful contraptions and they almost make one long for a crash in order to be allowed to try them out. In fact a short cruise in one of these boats could hardly be compared with the usual unpleasant drifting around in lifeboats or on rafts, as it would be more like a pleasant afternoon's punting on the lake.

A fat, inflated, golden-yellow rubber dinghy is shown in one of those little drawings I told you about. It looks a little like one of those fashionable lucky-charm bracelets, draped as it is with an anchor, a portable radio and a medicine chest. I can see another chest under one of the seats and this one's supposed to contain accessories, signalling equipment and emergency rations. Unfortunately the lid is hermetically sealed, so I can only guess at the contents of this surprise package. Anyway it will provide an unusual sort of a picnic, held, as it will be, on the sardines' playing fields, instead of the cows' feeding grounds. The

dinghy also contains a man in a green hat, smoking his pipe, and a woman in a black costume. They appear to be chatting by fits and starts, and this is hardly surprising when one considers that their presence in the boat, however nonchalant they seem to be, is due to the fact that their plane has crashed. You'd have fits and starts, too !

On the next page I find the exercices which helped them to indulge in these fun and games in the approved manner. Actually I haven't the time to swot up on navigating a rubber dinghy, not have I the necessary space in my small flat, but I can at least try out a few of the things which have to be done in this connection.

I stand in front of the mirror, dressed in the sober, but elegant fashion of intercontinental travellers (who are, as we all know, generally Very Important Persons, even when their journey's aren't really necessary). Satisfied that I'm suitably clothed for the occasion, I start on the exercises in numerical order :

1) I take off my collar and tie, which rather spoils my look of studied elegance.

2) I take off the glasses which I had donned for the occasion and I empty my pockets of any pointed objects they might contain.

3) If you're wearing high-heeled shoes, you must obey orders and take them off at once, otherwise you might damage the interior of the dinghy. On a rainy day, with the aid of my galoshes and a lofty umbrella, I measure precisely five feet two, so you'll understand when I say that I'm rather partial to built-up heels. However, "orders is orders," and I kick off my shoes without a murmur. I have to stand on tiptoe now to see myself in the mirror and I must admit I look rather queer, being collarless, tieless and shoeless. Let's hope that the crash doesn't make me lose my hair as well.

4) "Don't take off your clothes but, on the contrary, cover yourself as warmly as possible." O.K., if the book says so, I suppose it's all right to struggle into my "sheepskin liberty bodice" (kindly lent me by Meestaire Erique Barkairre), a polo-necked sweater (very Lana Turner-ish), my black velvet smoking jacket, an overcoat, the Balaclava helmet Auntie knitted me for Christmas, and my deerstalker cap. If my landlady comes in now with my mail, either she'll think I've gone balmy, or else she'll think she's crazy herself.

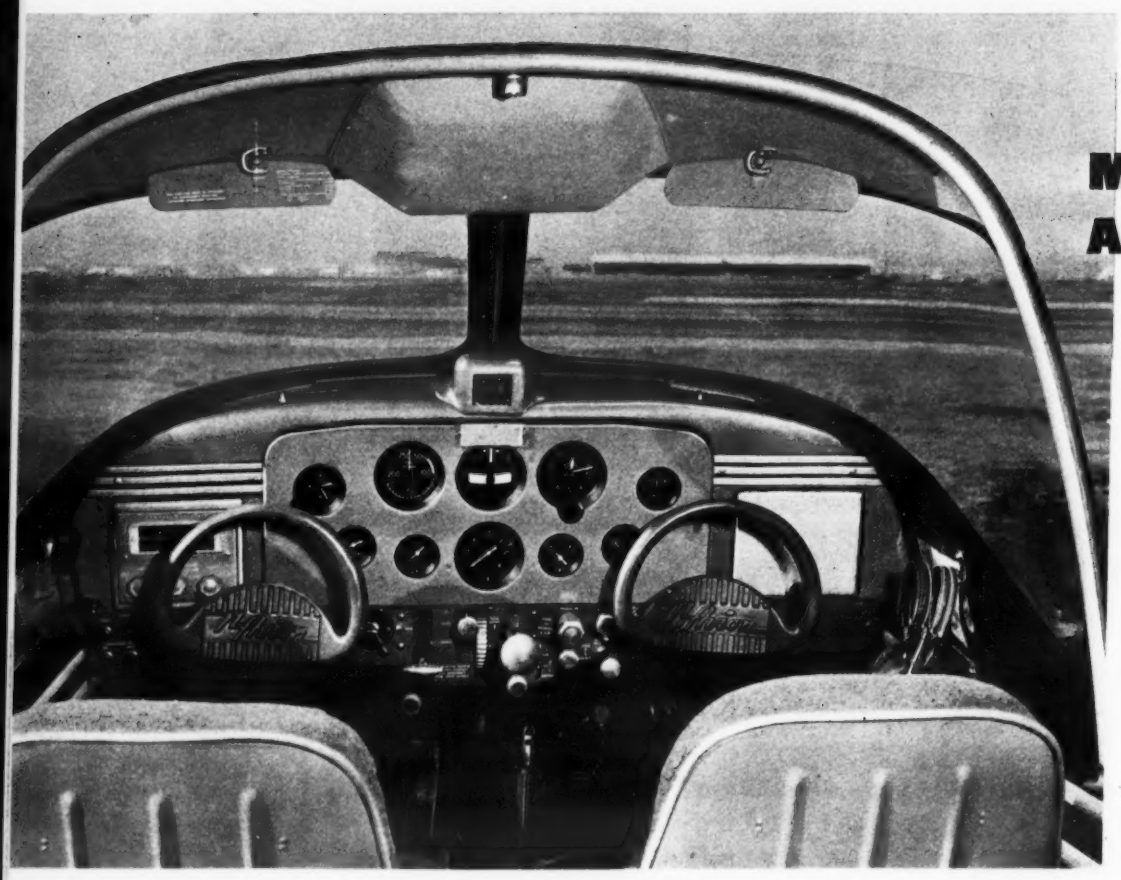
5) Finally, still following orders to the letter, I have to pretend that I'm actually in the open boat. As I've made up my mind I'll be better off as one of the first four passengers, I decide against sitting in an armchair. After carefully reading the brochure again, I squat down on

the floor, hugging the wall with my back and my head, bending my legs until my knees touch my chest and, folding my arms round my legs . . .

Yves Grosrichard.

Note from the Editor.

Our contributor had to interrupt his article for the time being as his landlady came into the room just at that moment. We can, however, assure our readers that he will conclude it very shortly. The six male nurses, who guard him night and day, have kindly promised that if he's a good boy they'll let him out of his strait-jacket in time for Christmas.



Modern Personal Aircraft

The Multi-Seaters

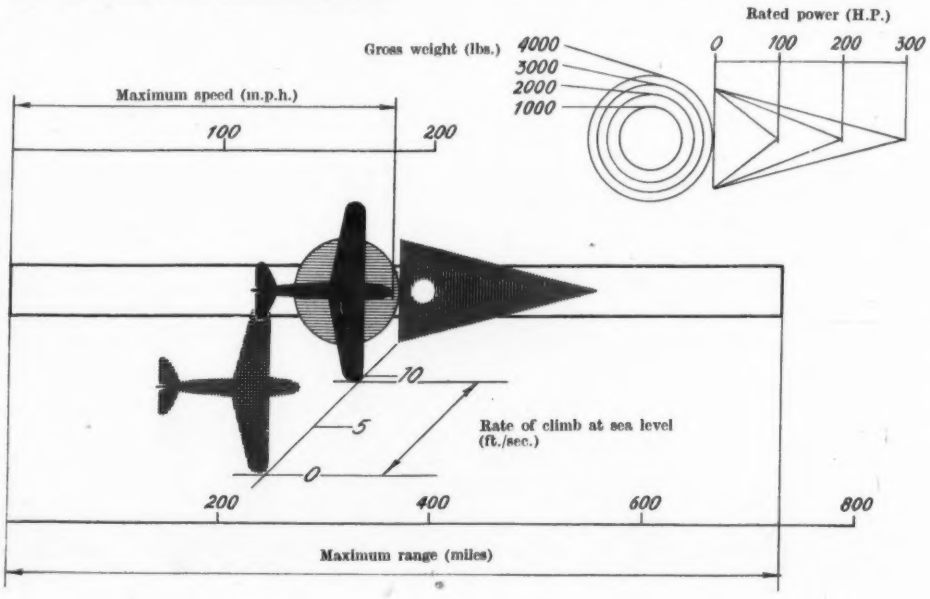
In addition to the two-seaters presented to our readers in last month's issue, there may be added *thirty* different makes of touring aircraft providing accommodation for three to five occupants. As mentioned earlier, flying is a social type of sport, and increasingly so if one judges by the sales statistics. In 1947, U.S. manufacturers alone sold 2,158 three-seaters ("Supercruisers"), 5,107 four-seaters (mainly "Voyagers" and "Flying Station Waggons," "Bonanzas" and "Navions"), and 818 "Seabee" amphibians. Among customers were businessmen, farmers, wealthy private pilots, and air taxi concerns.

Because the manufacturers of light aircraft had to find their customers mainly among people used to the comforts of motor cars and thoroughly pampered by the super conveniences provided by the automobile industry, it is understandable that designers endeavour to make the controls and instrument panels of their aircraft as simple as possible and as luxurious as those of motor cars. Although ordinary control columns are still to be found in several models ("Supercruiser," "Autocrat," "Norécrin," "Safir," and so on), the "limousine cockpit" is becoming characteristic of more and more modern light aircraft, *e. g.* products of Stinson, Bellanca, Beech, Cessna, Praga, Aero, etc. A good example is the instrument panel of the "Navion," shown above.

In this instance, the controls do indeed recall those of a motor car, and the pilot has his legs absolutely free. Though rudder pedals are also installed, they only need to be used for the take-off and landing, or for side-slip. In cruising flight, it is only necessary to use the handwheel, as a spring interconnection between the ailerons and rudder automatically takes care of balance. The compass (above), airspeed indicator (left), turn-and-bank indicator for blind-flying (centre), altimeter (right) and r.p.m. meter (below) occupy the central portion of the panel, and are surrounded by the clock, ammeter, and four instruments for engine control. Levers for ignition, electric starter, flaps, elevator trimming, airscrew pitch control, and throttle (here a push-pull knob) are within easy reach of both pilots. A two-way radio manufactured by General Electric, covering the usual frequencies, provides for transmission to and reception from ground stations (note the earphones on the right and the microphone on the left). The lever visible between the adjustable seats operates the wheel brakes. Another noteworthy feature of this aircraft is the wide field of vision and the convenient access to the cabin.

Even if the weather is only middling, an overland flight in one of these modern tourers

The scale silhouettes give an idea of the size and configuration of the aircraft. Their distance from the ground line on the left indicates the maximum speed. From the distance between the black silhouette and the grey silhouette may be seen how high the aircraft has climbed in one second (rate of climb at sea level). Other data given are gross weight (area of circle), rated power (area of triangle) and range (length of rectangular strip). If the aircraft is equipped with a controllable-pitch airscrew, this is indicated by a white circle inside the triangle.



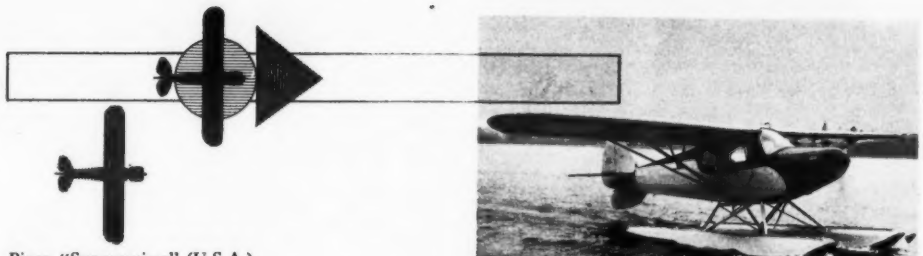
requires no more attention on the part of the pilot than for driving an automobile. As the occupants (and their luggage) are housed just as comfortably as in a car, and the low-speed characteristics offer complete safety, the present high speeds and long ranges alone of modern touring aircraft are a strong attraction.

Nowadays, the cruising speed of strut-braced high-wing monoplanes with fixed undercarriage lies between 100 and 125 m.p.h., and between 125 and 170 m.p.h. for low-wing designs with retractable undercarriage. The cruising speed, however, is not featured in the accompanying tables, since the information provided by manufacturers is not altogether uniform, and in any case these data are not very informative without an indication of the engine speed. Some firms give very high cruising speeds, amounting to 90 per cent. (and even 93 per cent.) of the maximum speed —in cases where the maximum permissible continuous r.p.m. is only slightly below the absolute maximum r.p.m.—whilst others give a mean value. Readers will recall that, at 60 per cent. rated power, the cruising speed amounts to about 82 per cent. of the maximum speed at the same altitude, and to about 90 per cent. at 75 per cent. rated power.

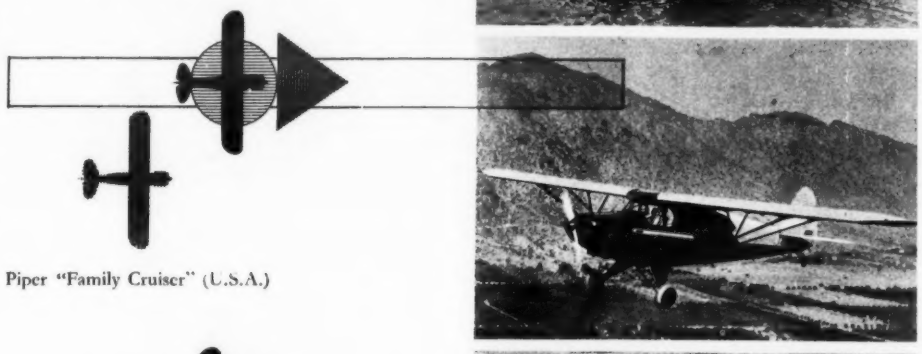
Assuming an economic cruising speed of only 80 per cent. of the maximum speed, in the schematic presentation we can read off, from the position of the aircraft nose in relation to the distance scale, the route distance covered in two and a half hours. Furthermore, the position of the nose within the range band also gives an idea of the longest possible flight duration.

The ranges mostly amount to between 500 and 750 miles. In this connection, it would seem as though the majority of manufacturers have secretly agreed to give only the theoretical maximum range, thus the range attainable if the pilot leaves the hangar with his tanks filled to the brim, flies at optimum altitude and on economical cruising power, and lands in a field with a teaspoonful of fuel left in the tank. Only very few firms are brave enough to indicate the practical range in still air for a recommended cruising speed and with fuel reserve ; and this is generally about 20 per cent. below the other indications. In order to provide a basis for comparison, we have plotted the theoretical values for each case in the schematic presentations, and added them in second instance in the tables. Certain aircraft provide for the installation of auxiliary fuel tanks for extended ranges. In this way even international distance record flights can be carried out with personal aircraft, in which connection we would recall the feat of Count Rosen, who flew non-stop from Stockholm to Addis Ababa (3,750 miles) in a Saab "Safir" on May 9th-10th, 1947, in 30 hours 52 minutes —taking off with an overload of 1,100 lbs., thus 50 per cent. above normal.

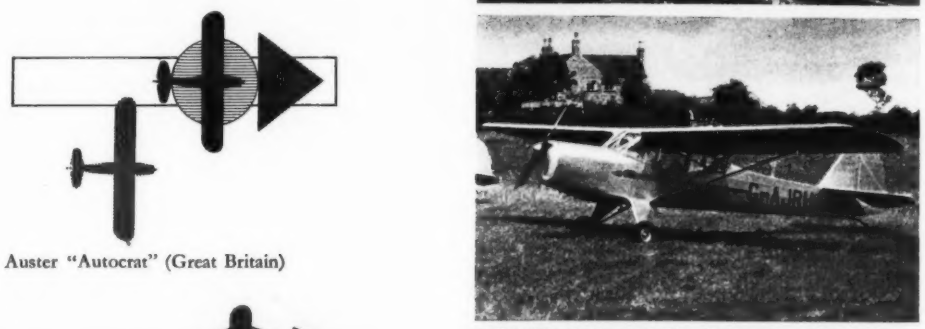
Initial rate of climb and service ceiling are of course considerably superior in the case of aircraft fitted with controllable-pitch airscrews. With power loading, wing loading and aerodynamic efficiency remaining the same, airscrews with automatic or manual pitch control improve climbing performance by 25 to 30 per



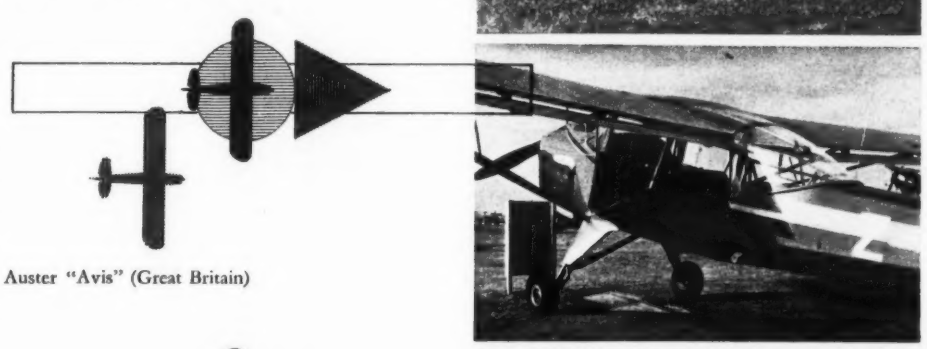
Piper "Supercruiser" (U.S.A.)



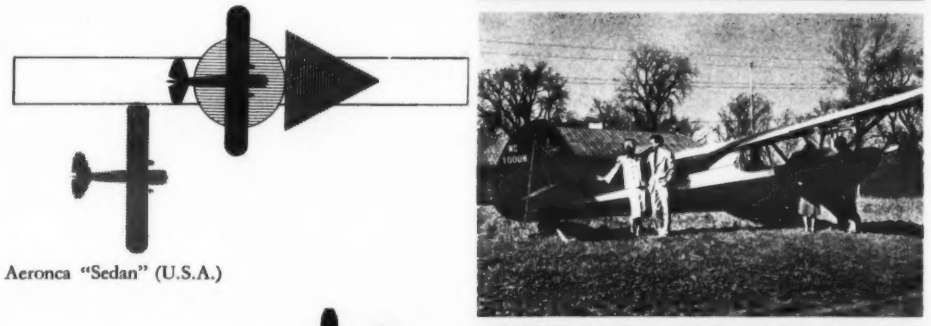
Piper "Family Cruiser" (U.S.A.)



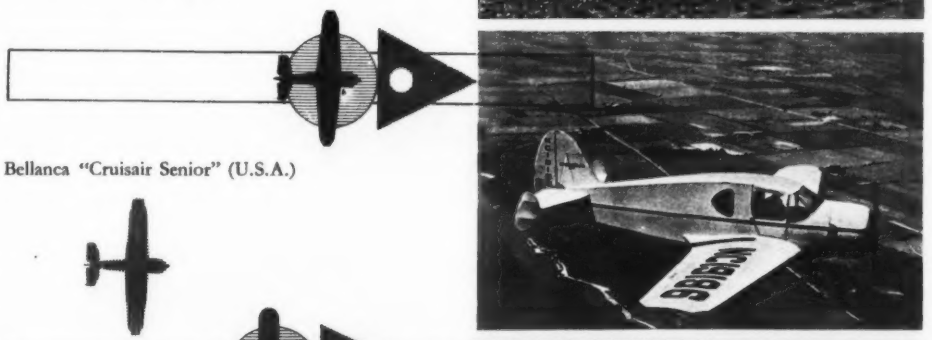
Auster "Autocrat" (Great Britain)



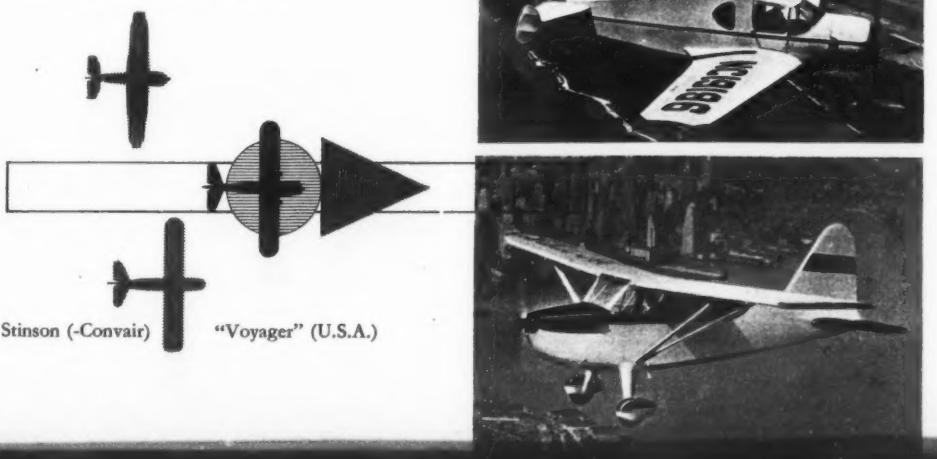
Auster "Avis" (Great Britain)



Aeronca "Sedan" (U.S.A.)



Bellanca "Cruisair Senior" (U.S.A.)



Stinson (-Convair) "Voyager" (U.S.A.)

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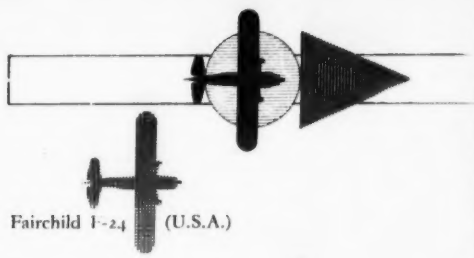
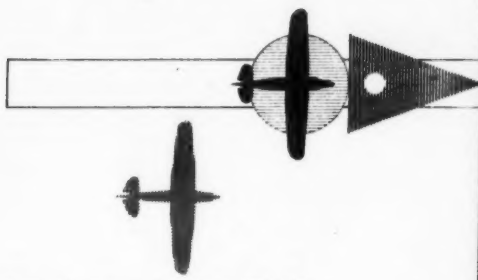


Fairchild F-24 (U.S.A.)



Percival "Proctor V" (Great Britain)

cent. and increase ceiling by 10 to 20 per cent. Among the most widely-used controllable-pitch two-blade airscrews, we might mention the Aeromatic "Aeromaster," Hamilton Standard "Controllable," Hartzell "Automatic" and "Hydro-Selective," and the manual and electric types developed by Beech Aircraft ; the British models made by de Havilland, etc., and the French Ratier "Héramatic."

As regards equipment with blind-flying instruments and radio, this information is contained in the tables. The only standard equipment in most types consists of a turn-and-bank indicator ; gyro-compass and gyro-horizon can usually be had only against supplementary payment.

Night-flying lamps are standard, and several types are also fitted with aircraft searchlights. As a battery (usually of 12 volts) is required for both these, nearly all models have an engine-driven generator, and the capacity of the accumulator, with 25 to 40 ampere-hours, is so chosen that the engine can be started electrically. A great number of types are equipped with ventilating and heating equipment, using the radiation heat from the exhaust manifold. A further feature which might be mentioned is that designers seldom omit to provide ample space for stowing luggage.

For reasons of space, only the line-production aircraft can be presented schematically here, whereby the limit for the metal types is less strictly observed than in the case of the others. However, the tables give sufficient data on the types which are only manufactured in medium series. Apart from the basic classification of the multi-seaters according to the main constructional materials used, it is not necessary to classify further according to the structural methods ; and in any case all the production types are presented pictorially.

If desired by customers, many light aircraft can be fitted with floats or skis in place of the usual undercarriage, though this is of course to the detriment of performance. As example, the accompanying photos show a Piper "Supercruiser" equipped with floats. An exceptionally versatile design of undercarriage in displayed by a British twin-engined prototype, the "Aerocar" built by Portsmouth Aviation Co.

Elliots of Newbury's "Newbury EoN" (Great Britain)

Czechoslovak National Corporation "Sokol"

Czechoslovak National Corporation "Zlin 122"

Società Aeronautica Italiana "Grifo" (Italy)

Skandinavisk Aero Industri KZ-VII (Denmark)

Chrislea "Super Ace" (Great Britain)

As the 1947 U.S. sales statistics show, the composite types, above all the "Supercruiser" and the Stinson four-seaters, have successfully held their own against the metal aircraft —very probably because of their considerably lower prices. Even the British wooden constructions ("Proctor" etc.) are still somewhat cheaper than the metal types of the same power class, above all on the Empire market. Of the twenty makes and sub-versions listed in table I, only nine are line-produced and, consequently, compared schematically. Apart from the "Proctor," they are all of composite construction. The only oddity would be the Aeronca "Sedan," which has a metal skin to its light-alloy wing, but since it has a fabric-covered steel-tubed fuselage, it rather belongs to the composite than to the metal types. As regards the small and medium series, the all-wood types are definitely in the lead ; among the composite ones may be listed the "Sokol," KZ-VII and the "Super Ace."

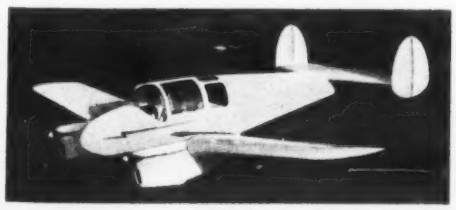
Nearly all have flaps. The "Avis," "Messenger," and the twin-engined "Gemini" have external flaps which, though they allow for low minimum speeds both at full r.p.m. and during landing, are all the same to the detriment of high-speed flight. The Stinson "Voyager" has fixed leading-edge slots opposite the ailerons, and the KZ-VII even has slats. Only four types have a retractable undercarriage ("Cruisair Senior," "Sokol," "Gemini," "Promotor"), and nearly all have tail-wheel types. The "Newbury EoN," Chrislea "Super Ace," Fokker "Promotor" and Praga E-211 are the only ones to have a nose-wheel undercarriage. Among the production types to have controllable-pitch airscrews are the "Cruisair Senior," "Proctor" and "Promotor." Against supplementary payment, Aeromatic automatic pitch-change or Sensenich two-position airscrews are available for the Piper "Supercruiser" and "Family Cruiser." Of the above types, the Praga E-211 is remarkable for its twin-engined design with pusher airscrew. In this way it offers a convenient and also extremely safe means of entering and leaving the cabin, better sound-proofing, and a high degree of safety in case of airscrew breakage. Worthy of notice is the low level of the cabin door, made possible by the nose-wheel undercarriage. A similar feature will be found later in the case of the Baumann "Brigadier" and the Caproni Model 193. Another light aircraft having a pusher airscrew is the single-engined Fokker "Promotor," which is consequently fitted with twin tail booms—a configuration which is again to be found in the SECAN "Courlis" metal high-wing monoplane.

Miles "Messenger" (Great Britain)

Manufacturer and Aircraft	No. of seats	Engine	c.p. airscrew [1]	Retractable undercarriage	Landing aids [2]	Blind-flying [3] and radio	Dimensions		Weights		Performance					Fuel reserve [5]	Price [6] ex-works
							Span	Wing area	Tare weight	Gross weight	Max. speed	Landing speed	Rate of climb	Service [4] ceiling	Range		
							ft. in.	sq. ft.	lbs.	lbs.	m. p. h.	m. p. h.	ft./sec.	feet	miles	U.S. Galls.	dollars
Piper Aircraft Corp. "Supercruiser" (U.S.A.)	3	100-H.P. Lycoming	(+)	—		(+)	35' 6"	179	950	1,750	115	50	10	13,000	600	38	3,495
Piper Aircraft Corp. "Family Cruiser" (U.S.A.)	4	110-H.P. Lycoming	(+)		+	(+)	35' 6"	179	1,000	1,850	125	43	9.5	12,500	600	35	3,985
Auster Aircraft, Ltd. "Autocrat" (G.B.)	3	100-H.P. Cirrus "Minor II"	—	—	+	—	36'	185	1,110	1,850	c. 115	c. 43	c. 9	c. 12,500	c. 310	18	5,140
Auster Aircraft, Ltd. "Avis" (G.B.)	4	145-H.P. "Gipsy Major 10"	—	—	+	+	36'	185	1,400	2,550	c. 125	43	8.5	10,000	500	41	c. 9,800
Aeronca Aircraft Corp. "Sedan" (U.S.A.)	4	145-H.P. Continental	—	—	—	—	37' 6"	200	1,150	2,050	120	53	11	12,500	440	38	4,795
Bellanca Aircraft Corp. "Cruisair Senior" (U.S.A.)	4	150-H.P. "Franklin"	+	+	+	+	34'	161.5	1,240	2,150	170	50	18.5	c. 16,500	650	40	6,350
Stinson Div. of Convair "Voyager" ("Flying Station Waggon") (U.S.A.)	4	165-H.P. "Franklin"		—	+	+	34'	155	1,295	2,400	c. 145	c. 55	10	15,500	560	50	6,249
Fairchild E&A Corp. Model F-24 (U.S.A.)	4	165-175-H.P. Warner or Ranger			+	+	36' 4"	193	1,650	2,560	135	53	11	14,000	620	60	6,956 (Warner) 7,256 (Ranger)
Percival Aircraft, Ltd. "Proctor V" (G.B.)	4	210-H.P. "Gipsy Queen II"	+	—	+	+	39' 6"	202	2,450	3,500	160	55	11.5	14,000	500 to 780	48 to 73	c. 11,600
Elliots of Newbury, Ltd. "Newbury EoN" (G.B.)	3	100-H.P. "Cirrus Minor II"		—	+	—	37'	173	1,310	1,950	115	c. 45	9	10,000	340	21	—
Elliots of Newbury, Ltd. "Newbury EoN-145" (G.B.)	4	145-H.P. "Gipsy Major 10"		—	+	—	37'	173		2,350	135	c. 50	c. 11	13,500	—		c. 8,000
Czechoslovak National Corp. "Sokol"	3	105-H.P. Walter "Minor"	(+)	+	+	+	32' 9"	118	915	1,700	150	c. 45	10	c. 13,000	340 to 620	18.5 to 33	6,000
Czechoslovak National Corp. "Zlin 122"	3	105-H.P. "Zlin Tomas 4"		—	+	(+)	34' 8"	158	1,015	1,765	135	c. 45	10	c. 12,000	620	36	
Soc. Aeronautica Italiana "Grifo" (Italy)	3	130-H.P. Alfa Romeo	(+)		+	(+)	32' 6"	164	1,370	2,120	150	c. 53	c. 11.5	—	500	32	c. 7,500
Skandinavisk Aero Industri (Kramme & Zeuthen) KZ-VII (Denmark)	4	125-H.P. Continental		—	+	(+)	31' 6"	140	1,020	1,985	125	c. 43	c. 10	c. 13,000	400	29	c. 6,900
Chrislea Aircraft Co., Ltd. "Super Ace" (G.B.)	4	145-H.P. "Gipsy Major 10"		—	+	(+)	36'	177	1,345	2,350	125	53	c. 11.5	—	420 to 720	30.5 to 54	c. 7,500
Miles Aircraft, Ltd. "Messenger" (G.B.)	4	155-H.P. "Cirrus Major III"	—	—	+	(+)	36' 2"	191	1,450	2,400	135	45	12	—	560	43.5	—
Miles Aircraft, Ltd. "Gemini" (G.B.)	4	2 × 100-H.P. "Cirrus Minor II"	—	+	+	+	36' 2"	191	1,930	3,000	150	c. 53	11	13,500	560	43.5	c. 14,000
V.N.V.F. Fokker "Promotor" (Holland)	4	190-H.P. Lycoming	+	+	+	(+)	39' 4"	188	2,120	3,140	140	55	c. 9	c. 12,000	420 to 530	42 to 53	c. 13,600
Czechoslovak National Corp. "Praga E-211"	4	2 × 105-H.P. Walter "Minor"	—	—	+	—	41'	226	2,095	3,090	150	50	11.5	—	350 to 530	40 to 60	—

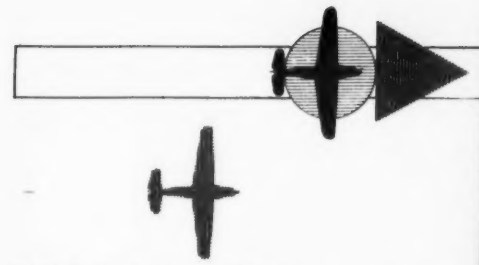
1. The upper sign is indicative of the flight performance; a plus sign in parenthesis means a supplementary cost for the equipment.
2. Two plus signs mean more effective landing aids, *e.g.* powerful flaps, or slats. In the case of such types, the stalling speed is usually very much below the landing speed.
3. The upper sign refers to blind-flying instruments, and the lower sign to radio equipment; parenthesis mean the same as indicated under footnote 1.
4. At service ceiling altitude the aircraft should still possess a rate of climb of 1.5 ft./sec. on full power. Absolute ceiling is on the average 2,000 to 2,600 feet higher.
5. The maximum tank capacity is given in order to justify the range; in certain cases this includes the capacity of auxiliary tanks.
6. Prices are converted in accordance with the exchange rates prevailing in April, 1948: $1 = 5/- = Sw. frs. 4.28 = Fr. frs. 325 = Sw. kr. 3.60 = Dan. kr. 4.78 = gldrs. 2.63 = Lire 600.

Miles "Gemini" (Great Britain)

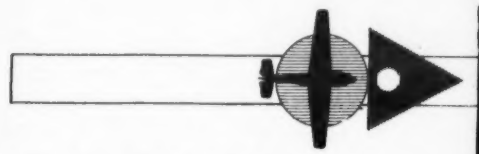


Czechoslovak National Corporation "Praga E-211"

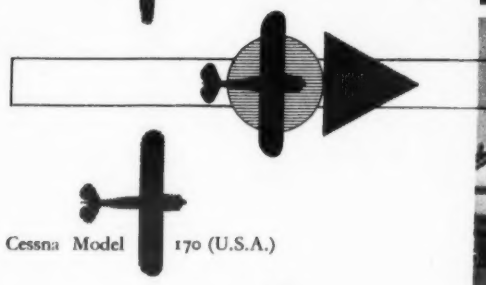
Fokker "Promotor" (Netherlands)



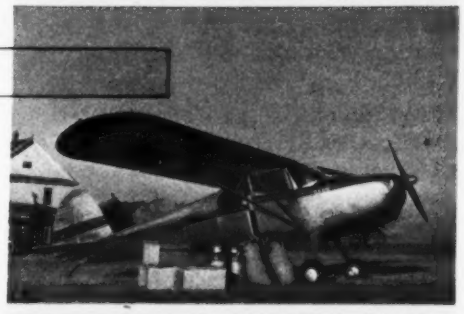
SNCA du Nord "Norécrin" (France)

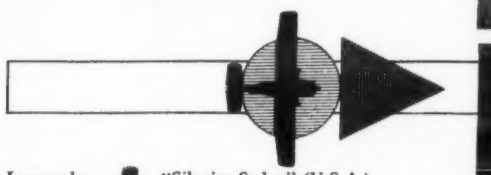


Svenska Aeroplan "Safir" (Sweden)

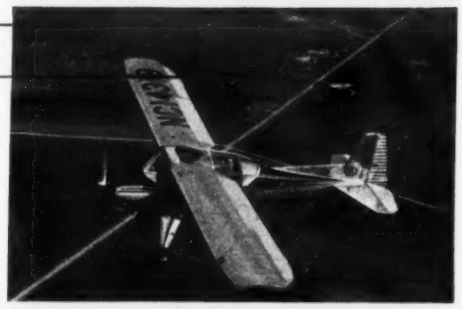


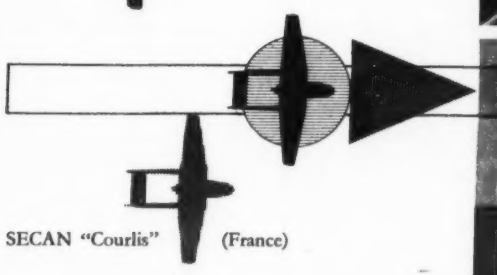
Cessna Model 170 (U.S.A.)



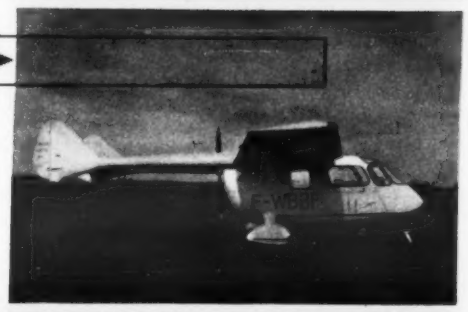


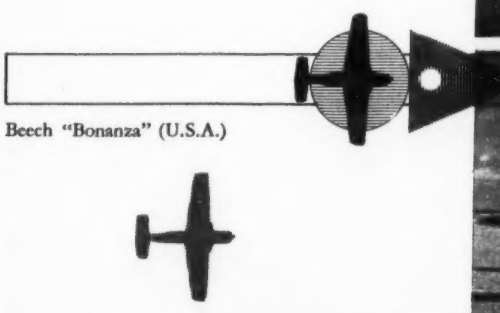
Luscombe "Silvaire Sedan" (U.S.A.)



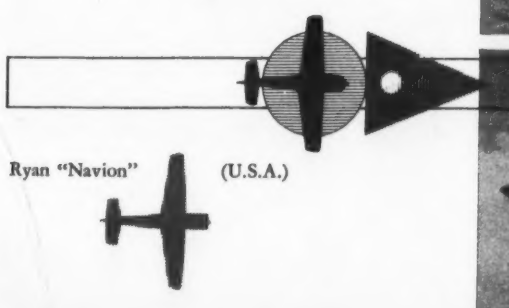


SECAN "Courlis" (France)





Beech "Bonanza" (U.S.A.)



Ryan "Navion" (U.S.A.)

METAL MULTI-SEATERS

Since the 240-H.P. Messerschmitt "Taifun," fourteen years ago, quit the rank and file thanks to its superior performance, the low-wing monoplane configuration with retractable undercarriage has been fostered with particular care. In the meantime, engine power has been gradually reduced, and the tail-wheel undercarriage replaced by the nose-wheel design. The butterfly empennage, first introduced with the Beech "Bonanza," helped further to reduce parasite drag and consequently to improve flight performance considerably. This type of tail assembly, consisting of two stabiliser-rudder units mounted with an approx. 30-deg. upward dihedral, takes care of pitch and yaw, and is operated through ordinary manual and pedal controls. Another aircraft featuring this type of empennage is the British "Satellite," an ultra-modern five-seater low-wing prototype of magnesium alloy, built by Planet Aircraft, Ltd., and powered by a de Havilland "Gipsy Queen 30" pusher engine.

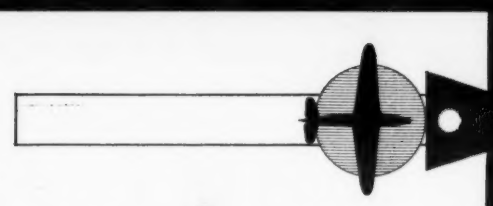
In addition to the low-wing designs, meanwhile, there are also the high-wing monoplanes: among these the cantilever types (SECAN "Courlis," Cessna 190 and 195) and the strut-braced designs (Cessna 170, Luscombe "Silvaire Sedan"). In general, and as regards undercarriage arrangement, all remain true to the conventional design principles; as a matter of fact, the "Courlis" is the only model to feature a (fixed) nose-wheel undercarriage. All the metal designs have flaps, and more than half are equipped with controllable-pitch airscrews.

The Spartan "Executive," an American five-seater equipped with a 450-H.P. Pratt & Whitney engine and a retractable nose-wheel undercarriage, and having a maximum speed of 215 m.p.h., represents a transitional type between the tourer and the feeder transport. Despite the fact that it is constructed as a typical private touring aircraft, with an undivided cabin, its more powerful engine definitely brings it into a higher power class. Among the prototypes should be mentioned the three-seater version of the French Morane-Saulnier MS-570, which has a 140-H.P. engine; the four-seater Prestwick "Pioneer," a 250-H.P. slow-flying aircraft developed by Scottish Aviation Ltd., and fitted with double flaps (combined Fowler and split flaps) and slats; and the U.S. Puget "Wheelair," powered by a 190-H.P. pusher engine.

There are at present quite a number of twin-engined limousine-type designs for four to six occupants being developed and tested, though not yet in production. Those that have already taken the air are listed in table II. A new project, which incidentally resembles the "Brigadier," is the five-seater Ca 193, with two 155-H.P. pusher engines, designed by the Caproni concern in Milan. Among other prototypes may be mentioned the Czecho-

slovakian "Avia 38" and the experimental "Cloudster" of Douglas Aircraft Co.

All the twin-engined metal designs of recent years, which are of course fitted with controllable-pitch airscrews, retractable undercarriage, flaps, blind-flying instruments and usually with rather elaborate radio equipment, endeavour to offer private pilots and air taxi guests increasing degrees of comfort, safety, speed and range. Whether they can be produced in large series and sold in satisfactory numbers, is still a commercial problem. Meanwhile, however, improved manufacturing methods, new constructional measures to reduce the number of separate parts, cheaper engines and accessories, may perhaps solve this problem in the none-too-distant future. *Ri.*



SNCA du Nord "Noralpha" (France)

Cessna Model 195 (U.S.A.)

Manufacturer and Aircraft	No. of seats	Engine	c. p. airscrew	Retractable undercarriage	Landing aids	Blind-flying and radio	Dimensions: span	Dimensions: Wing area	Weights: Tare weight	Weights: Gross weight	Performance: Max. speed	Performance: Landing speed	Performance: Rate of climb	Performance: Service ceiling	Performance: Range	Fuel reserve	Price ex-works
							ft. in.	sq. ft.	lbs.	lbs.	m. p. h.	m. p. h.	ft. sec	feet	miles	U.S. G.	dollars
SNCA du Nord "Norécrin" (France)	3	140-H.P. Renault	—				33' 6"	140	1,370	2,120	165	53	*c.* 12	14,000	590	32	*c.* 6,000
Svenska Aeroplan A.B. "Safir" (Sweden)	3	145-H.P. "Gipsy Major"				(-) (-)	34' 9"	146	1,350	2,200	165	53	17.5	15,000	580 to 720	38	*c.* 9,200
Cessna Aircraft Co. Model 170 (U.S.A.)	4	145-H.P. Continental				(-) (-)	36'	175	1,200	2,200	140	50	11.5	15,500	*c.* 600	37	5,475
Luscombe Airplane Corp. "Silvaire Sedan" (U.S.A.)	4	165-H.P. Continental	(+)			(-) (-)	38'	164	1,280	2,280	145	50	15	*c.* 15,500	500 to 620	42	6,995
Soc. d'Etudes et de Constructions Aéro-Navales "Courlis" (France)	4	190-H.P. Mathis				(-)	37' 8"	206	1,970	3,180	155	53	*c.* 10	*c.* 13,000	*c.* 750	53	*c.* 9,800
Beech Aircraft Corp. "Bonanza" (U.S.A.)	4	165-185-H.P. Continental					32' 10"	178	1,560	2,550	185	53	16	18,000	750	39.5	9,445
Ryan Aeronautical Co. "Navion" (U.S.A.)	4	165/185-H.P. Continental					33' 5"	184	1,680	2,750	160	53	14	15,500	500 to 650	39.5	8,750
SNCA du Nord "Noralpha" (France)	4	240-H.P. Renault					37' 8"	187	2,080	3,500	190	60	*c.* 16	*c.* 16,500	750	69	*c.* 12,000
Cessna Aircraft Co. Model 190 (U.S.A.)	5	240-H.P. Continental					36' 2"	*c.* 215	2,030	3,350	170	53	17.5	16,000	750	80	12,750
Cessna Aircraft Co. Model 195 (U.S.A.)	5	300-H.P. Jacobs					36' 2"	*c.* 215	2,050	3,350	180	53	20	18,500	750	80	13,750
Czechoslovak National Corp. "Aero 45"	5	2 · 105-H.P. Walter "Minor"	(-)				40' 3"	184	1,810	3,100	180	*c.* 53	16.5	16,500	560	45	17,000
Baumann Aircraft Corp. "Brigadier" (U.S.A.)	5	2 / 125-H.P. Continental					41'	*c.* 215	2,150	3,500	170	55	20.5	18,000	750	60	*c.* 15,000
Portsmouth Aviation, Ltd. "Aerocar Major" (G.B.)	5	2 / 155-H.P. Cirrus "Major"				(-)	42'	255	2,600	3,950	165	*c.* 53	19.5	19,500	670 to 1,000	71.5 to 110	*c.* 19,400

Czechoslovak National Corporation "Aero 45"

Baumann "Brigadier" (U.S.A.)

Portsmouth Aviation "Aerocar Major" (Great Britain)

The Air Hostess Told Us ...

Our Favourite Air Hostess is the kind of person who wears her emotions on the outside. The other day Esmeralda's aircraft was stuck at one of those fog-bound airports in the Northern Hemisphere where the end of Winter imperceptibly merges into early Autumn. She and the rest of the crew were browned off : they had been waiting two days for the weather to clear. But the thing which aroused their temper so you could have fried an egg on it occurred when Esmeralda asked one of the locals, does that rain *ever* stop in this place ? He replied, oh yes, we get oodles and oodles of snow in the Winter. To crown it all, our Favourite Air Hostess came across a notice in the newspaper stating that Paul Mantz, winner of the 1947 Bendix Trophy Race, had sunk fifty thousand perfectly good smackers (dollars to youse guys) into the formation of a new company called Weather-Air, Inc., which set itself the task of specializing in artificial rain-making. I ask you, says Esmeralda, whatever does *anybody* want to make *artificial* rain for ? Paul Mantz should stooge around this particular locality for a while, he would get more than he could cope with, for free.

However, the implications of this announcement are extremely far-reaching. The weather is going to be controlled, rationalized, regimented and—in some parts of Europe—nationalized. The weather's had it, in other words. It will have to conform. But one thing remains to be done : directives must be elaborated, channels must be explored and no stone must be left unturned in an effort to determine exactly what behaviour the weather should assume, in other words, where and when it should be how.

The effect of weather control on air transportation would be immediate, enormous and evident. In this air-corridor-minded age of travel, rain and fog-free lanes could be ploughed, so to speak, through the thickest murk. Airliners would wing their way along spacious paths in brilliant sunshine or romantic moonlight. Passengers would see more interesting things than endless expanses of cloud. Flying would be safer, blind-flying equipment redundant, passengers fares would fall and airline profits soar . . .

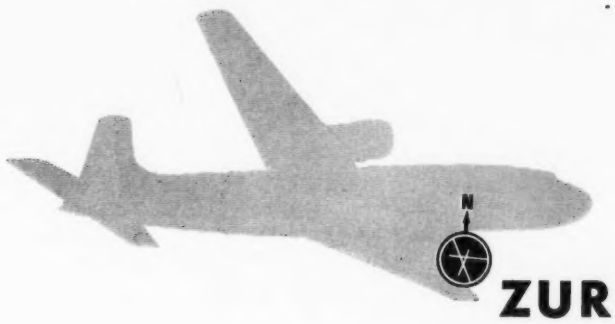
But here, our Favourite Air Hostess observes, interests are bound to clash. Take the common farmer, for instance, whose vegetables would dry out if his property happened to lie under one of the lanes. Or take the garden-variety of honest citizen, who anyway couldn't care less about air corridors than he does now but would like all the rain to fall between 11 p.m. and 7.30 a.m. He would encounter immediate opposition not only from pilots flying the night runs, but also from sentimental young couples in May, the milkman, owls, and assorted cat-burglars. Not to speak of the chap who goes out at nine every evening to buy himself just that odd noggin and, after loading up with lashings of Scotch and scads of gin and having a wizard time all round, finds himself trundling home in driving rain at four a.m., wet inside and out. These people would want it to rain in daytime—much to the disgust of the normal run of transport pilots, weekend flyers, bathing-resort operators, cotton pickers and the like.

What would obviously be needed would be a Law to Regulate the Weather. This means that an Authority would have to be created to coordinate the diverging interests. This International Weather Control Organization would have to be part of the United Nations. It would include an incredible number of Committees, Sub-committees and Sub-sub-committees. There would be a Committee of Flying Weather, with sub-divisions for day, night, sporting and various other sorts of flying ; an Agricultural Committee with sections for farmers wanting dry or wet weather ; Committees of Nightlifers, Burglars, Nightwatchmen, Naturewalkers, etc., etc. Hundreds of thousands of people would be employed, all drawing fat screws at the end of the month and thereby contributing to prosperity in general. Headquarters would have to be the Sahara or a similar place, providing the Organization with an opportunity to carry out experiments on a vast scale.

The major task of this I.W.C.O. would obviously be, according to Esmeralda, to prevent the weather from being used for belligerent purposes. If the Weather fell into the hands of an Aggressor Nation with Imperialistic Designs, this nation could employ it to dehydrate its enemy during the first six months of the year and flood him for the following six. Which is sufficient proof that the Weather must be an international responsibility.

TAILPIECE

Strange flowers, Esmeralda says, sometimes bloom behind the Iron Curtain. The other day the Hungarian daily press published a story datelined from Berlin, according to which the Anglo-American authorities had issued an order decreeing that all female passengers on the internal airlines in Bizonia would be required to wear slacks in future. This was necessary in order to avoid "scandalous sensations" in case the ladies found it to their advantage to bail out by parachute. Hm . . . Esmeralda says she does not fully understand, for ladies wearing the "new look" should need no parachute at all. *Bl.*



ZURICH-KLOTEN
Intercontinental Airport

The Expansion of Swiss Airports

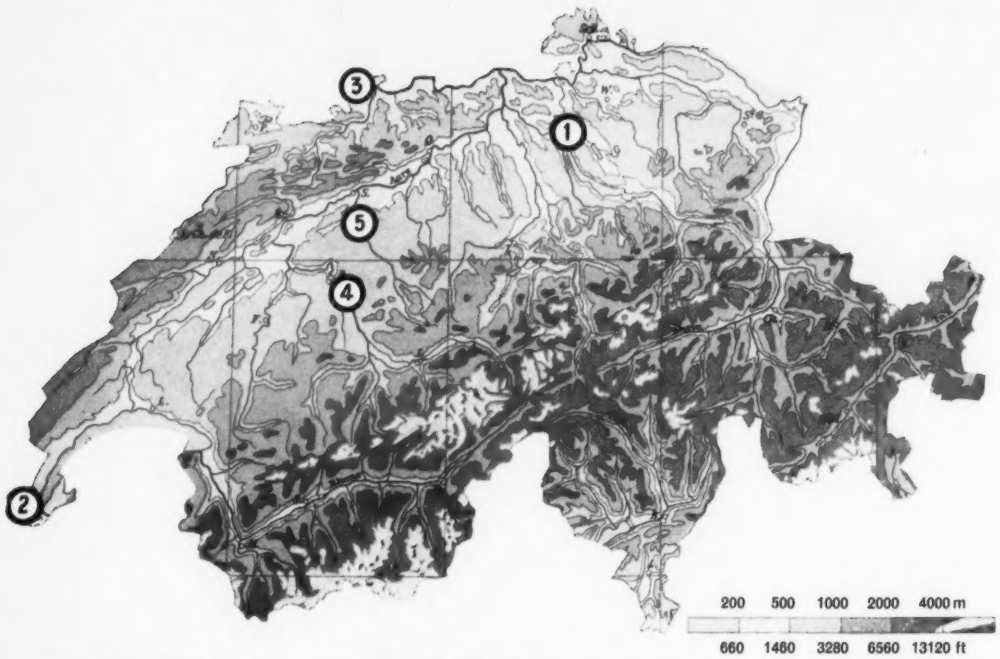
By E. AMSTUTZ, Professor at the Swiss Institute of Technology and Government Commissioner for Civil Aviation.

The inauguration of the west runway, soon to be followed by the completion of the instrument runway of Zurich's new airport at Kloten, will signify an important step towards the realisation of the Swiss airport programme. Although neither the first stage of Zurich-Kloten expansion has yet been terminated, nor the system of Swiss airports definitely consolidated, it is all the same worth looking back on the initiation and development of Switzerland's airport programme. This gives rise to the question of how far the early considerations apply in respect of present experience, and, in view of the new knowledge gained, to what extent the programme will have to be modified for a further development of Swiss airports.

Before the war, Swiss civil aviation relied upon the three airports at Basle-Birsfelden, Geneva-Cointrin and Zurich-Dubendorf. Because Basle-Birsfelden had soon to cede its terrain to a port on the Rhine and an electricity works, and an expansion of Zurich-Dubendorf (simultaneously serving as an air corps base and therefore overcrowded) was difficult, the authorities realised already in the '30's that the Swiss airport problem would have to be thoroughly studied anew. As the outbreak of war caused a total paralysis of Swiss commercial flying, and these conditions, apart from a few miserable and brief exceptions, were to remain unchanged for six years, there was no great desire to undertake any long-term planning. Moreover, the dangers which threatened Switzerland at that time mobilised the country's thoughts and energies to the full. It was not before Autumn of 1941 that the authorities began seriously discussing the problem of Swiss airports. An October, 1941, issue of the magazine" Strasse und Verkehr " was a special number devoted to these questions.[1] There the opinion was expressed that small Switzerland would have to limit herself to the construction of only one airport, but that this airport would have to be generously furnished with several large and elaborately equipped instrument runways. Its situation should be dictated solely by the most favourable topographical conditions, without taking into account its shorter or longer distance from important centres. The writer of the present article opposed this concept and endeavoured to prove that in " small " Europe, the advantages of commercial flying could only be fully exploited if the airports were located as near as possible to principal cities. However, this would make it necessary to build three or four airports for continental flying, which would have to be in the vicinity of Basle, Geneva, Zurich and the country's capital, Berne. But because Switzerland would later have to obtain a link with intercontinental air transport, one of these airports would have to be fitted with runways sufficiently long and strong to cope with modern, long-range airliners, and otherwise be able to meet the high demands as regards freedom from obstacles which such aircraft place. At that time, however, the opinion reigned that, due to topographical reasons, such an airport for intercontinental traffic could only be built in the centre of the Swiss plateau, at some spot in the vicinity of Utzenstorf. In this location, moreover, it could simultaneously serve as a municipal airport for Berne.

These last considerations subsequently formed the basis of the programme for developing Swiss airports. They were presented for the first time on April 24th, 1942, to the Federal, Cantonal and Municipal authorities interested in civil aviation. Meanwhile, as it always happens in the case of projects which extend far beyond the known and usual limits, this programme, too, was at first greeted with a great deal of scepticism, and notably the postulate of an intercontinental airport was rejected as exaggerated. From the beginning, however, the Governments of the Cantons of Geneva and Berne were the exceptions in the ranks of the sceptics. In Geneva, the current work for a modest enlargement of Cointrin airport was soon transformed into a generous plan for expanding it to a full-size intercontinental facility. Despite difficulties due to the War, this plan was pursued very energetically, to such an extent that, shortly after the cessation of hostilities, a 6,500-foot concrete runway was completed. The possibility, which existed only in Geneva, of going to work immediately, was seized on in a very praiseworthy manner. Similarly, little time was lost before Berne began elaborating very detailed plans for an intercontinental airport which was to have been erected in the neighbourhood of Utzenstorf. At the moment when work in Berne and Geneva was beginning to show visible results, the Zurich authorities became afraid that they would be left at the post, and also put their heads together. Again, it was seen that a substantial expansion of Dubendorf airport was impossible, and, suddenly, a new and surprising solution was suggested—to build a big airport on the military training grounds at Kloten. As for who the real " inventor " of Kloten was, nobody knows up to today ; I have it from a reliable source that the first suggestion was put forward by one of Swissair's oldest airline captains, Franz Zimmermann. Very careful studies soon revealed the possibility of building at Kloten an airport which would satisfy the most exacting conditions. And it also meant that this intercontinental airport would be in the immediate vicinity of the biggest city in Switzerland, and in the area where the most important commercial and indus-

[1] " Strasse und Verkehr," special number containing article " Landes-, Regional- und Ortsplanung : Schweizerische Flugplatzfragen" (Vol. 27, No. 20, Solothurn, Oct. 3rd, 1941) ; and " Strasse und Verkehr," 2nd special number, " Landes, Regional- und Ortsplanung : Grundlagen und Vorschläge für ein Gesamtausbauprogramm der schweizerischen Zivilflugplätze" (Vol. 28, No. 9, Solothurn, May 1st, 1942).



1. Zurich-Kloten airport
2. Geneva-Cointrin airport
3. Basle-Mulhouse airport
4. Berne-Belpmoos airport
5. Projected airport at Utzenstorf, forseen at the time as an intercontinental base and Berne's municipal airport, and proposed as the " Swiss central airport."

trial centres are located. The advantages were only too obvious. This meant that the fate of the Utzenstorf project was sealed ; it was no longer necessary to sacrifice some of the most valuable agricultural land around Berne for building a big airport. For the Bernese authorities, who had fostered their project with a great amount of faith and energy, this was a bitter disappointment. However, their great contribution towards the solution of the Swiss airport problem merits the fullest amount of gratitude.

The airport programme was initially incorporated in the big employment programme drawn up in preparation for the then feared post-war crisis. All project work was financed by what were known as the credits for creation of employment. These projects, just like the elaboration of the airport programme, were rendered considerably more complicated owing to the fact that Switzerland was then completely encircled by the Axis powers and therefore almost entirely cut off as regards the exchange of ideas with the rest of the world. The extremely rapid development of aeronautics in the belligerent countries could only be followed with the help of very occasional and fragmentary data, which were utilised on the basis of general principles of flight performance theory. It was a very great and welcome help when, at the beginning of 1944, a single copy arrived in Switzerland of a Wilbur Wright Memorial Lecture on " Post-War Transport Aircraft," [2] delivered by Dr. Edward P. Warner, now President of ICAO. This enabled people over here to take their first post-war look at the authoritative and fundamentally sound opinions of foreign countries on the future development of civil air transport. Then, at the end of 1944, further important documents could be brought back home from the International Civil Aviation Conference in Chicago. For many countries, including Switzerland, this conference signified the definite resumption of international aeronautical co-operation.

Towards the end of 1944, however, it also became clear that the airport programme by now divorced from the unemployment programme, should be put into action as soon as possible—at least as regards its most important elements—if Switzerland were not to miss the post-war civil aviation bus. Thanks to the foresight and determination of the Head of the Post Office and Railways Department, Federal Councillor Dr. Celio, it was possible to submit a message and a Bill for expanding civil airports to the Federated Councils as early as February 13th, 1945. The National Council and subsequently the Council of States started discussions immediately, and brought them to a conclusion after only two sessions, so that the Federal Law bears the date of June 7th, 1945. It approved the airport programme briefly sketched above, and regulated the extent to which the Federal Government should contribute financially towards its realisation. The impressive feats of the Allied air forces during the preparation and execution of the invasion, and in the subsequent campaigns in France and Germany, greatly contributed towards bringing home the importance of fostering generous measures for assuring Switzerland's part in European and world aviation. The many emergency landings made by American four-engined bombers on Swiss airports, which were nearly always executed with great difficulty and frequently entailed severe damage, served as further proof that Swiss airports were far too small. All this probably contributed towards the fact that the demands for appropriations for Zurich-Kloten and Geneva-Cointrin airports were approved by a high majority of votes on the part of the Federal Assembly, the Cantonal and Municipal Parliaments, and in the subsequent national polls.

Zurich-Kloten is now about to start restricted operations, whereas Geneva-Cointrin has long enjoyed a lively traffic. Although Geneva-Cointrin is listed in the airport programme as the " municipal airport for continental air transport," overseas aircraft take off and land on its 6,500-foot runway almost daily. Since 1946, Cointrin has maintained Switzerland's direct connection with world aviation. Owing to unfavourable conditions, Berne is a little behind with the expansion of Belpmoos airport, which is now to be retained, but already has a direct airline link with London. In Basle, where no big airport could be built on Swiss soil, a provisional solution was reached by friendly co-operation with the neighbouring French : this has resulted in the Basle-Mulhouse airport, near Blotzheim, which is already in operation. Negotiations are now proceeding for an official treaty, which is to serve as basis for the realisation of a definite project. This airport, too, can be expanded to considerable dimensions, and its vicinity is sufficiently free from obstacles.

To judge from experience, this expansion of three or four Swiss airports seems to be justified and useful. To have built, instead, one single central airport on the Bernese plateau would certainly not have constituted a suitable solution. The biggest surprise since the time of the first controversies about the airport programme is certainly the cheerful fact that the airports of Basle-Mulhouse, Geneva-Cointrin and Zurich-Kloten have or are being built at reasonable cost, and are, or shall be, capable of coping with the heaviest aircraft used today in long-range and overseas civil air transport. For Geneva, which has resumed its international significance as the European seat of the United Nations, in whose building the second general assembly of ICAO is now being held, this is of special importance. The question thus arises whether it was wrong to develop only one of these airports, namely Zurich-Kloten, into an intercontinental airport. One will certainly answer in the negative. The development of aeronautics does not remain at a standstill, and the airport programme is an example of long-term planning. The time can and certainly will come when intercontinental transport aircraft will subject runways to conditions of dimension and strength far in excess of those placed by present long-distance airliners, and this to such an extent that it will only be worth while and justifiable for one national airport to fulfil them. Right from the beginning, when the size of the runways was decided, this possibility was taken into account ; and, should the need arise, it will be possible to lengthen

[2] Dr. Edward P. Warner : " Post-War Transport Aircraft," The 1943 (31st) Wilbur Wright Memorial Lecture, Aeronautical Reprint No. 98 of the Royal Aeronautical Society, London, 1943.

these runways considerably. It is encouraging to know that there are no obstacles to prevent all these airports from being expanded so as to suit new conditions, and thus —according to Swiss opinion—even for a distant future, those obstacles have been eliminated which today make it so difficult to expand the main railway stations in Switzerland.

In their determination to bring about the realisation of the Swiss airport programme, the Federal Government and the participant cantons and towns have taken on a heavy financial burden. It is anticipated here that civil aviation will progress sufficiently to justify the optimism shown ; and experience gained in the last three years has served to strengthen these hopes. Another hope is that we shall soon see a lessening of the present depressing obstacles to free travel, to commerce and financial exchange. Not before they have disappeared completely will civil aviation be able to unfold freely and evenly.

Switzerland is a small country without outlet to the sea. By flying over the territory of neighbouring friendly states, the commercial transport aircraft has enabled the Swiss to open up direct connections with far distant countries. In her airports, therefore, Switzerland sees a medium for more intense, rapid and safe traffic with all the countries of the world.

Planning and Construction

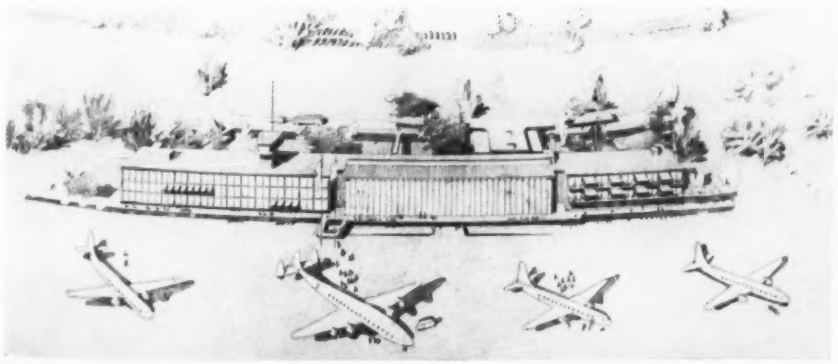
During the war one was used to thinking of a new airport as merely one or more runways which were as long as possible. If somewhere in the vicinity of these concrete strips a few sheds were erected, in which ground personnel and crew could obtain shelter during really bad weather, then the installation was regarded as a fairly important airport. Not before the middle of 1942, by which time the basis of the new airports, the runways, were in existence, did one proceed with the development of those airports which were foreseen and suitable as terminals for international civil aviation. Despite this, meanwhile, there are many well-known airports today which, constructed during the course of the last five years, still have to manage with temporary buildings and cannot yet accord travellers the measure of comfort to which they have a right.

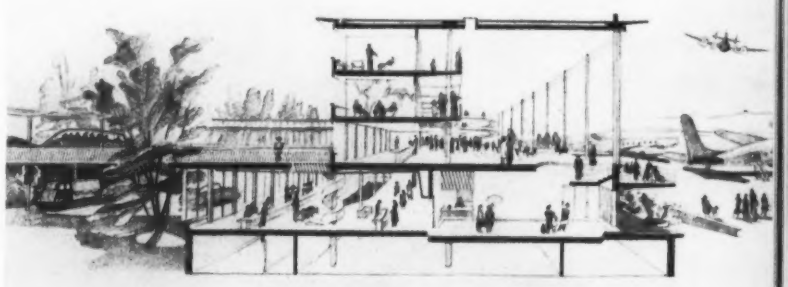
New airports, especially those which correspond to the highest or second-highest international standards established by ICAO and thus represent intercontinental airports, are not built in a day. The authorities responsible for designing the new airport for Zurich had to fulfil two conditions : first an airport, or a system of runways, which met with present demands and could cope with every type of modern long-range airliner, had to be built and made serviceable within the shortest possible time ; second, the airport had to be designed in such a manner that not only those decisions and regulations made by ICAO during the building period could be taken into account, but that all airport elements could individually and effortlessly be modified to suit the increasing requirements of the future.

This principle, which undeniably incurred considerably higher expenses in the beginning, formed the providential basic idea behind the planning of Zurich airport and simultaneously offered the guarantee that the invested capital was placed in the best possible manner.

Passengers, to whom much of the most important equipment of an airport usually remains hidden, are apt to judge merely by the convenience and comfort which they find in the terminal building. All buildings had therefore to be preceded by extremely careful planning. Of special importance was to achieve, right from the beginning, a sharpest possible division of the individual constructions : terminal building for passen-

THE CENTRE PART OF THE TERMINAL BUILDING contains all the rooms necessary for handling passengers and their luggage. The city-to-airport service leads directly to the level of the first floor, on which there is a joint hall for arriving and departing passengers. Below, with access to the apron, are the customs facilities and additional waiting rooms.



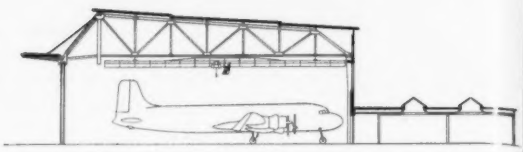


gers, freight building, technical installations for scheduled flying, facilities for handling feeder services and private aircraft.

The traffic centre of every airport is constituted by the terminal building. Based on the assumption that it will be some time, even under the most favourable development conditions for aviation, before Zurich-Kloten will have to handle more than 2,000 persons an hour, the central part of the terminal building has been designed to cope with this passenger volume—though initially it will only be able to deal with about 300 people per hour. The final design—assuming a passenger accommodation factor of 50 persons per airliner—corresponds to about 40 departures or landings per hour. A higher traffic density than this would probably be beyond the scope of the intended runway system, consisting of three separate runways. In order to assure quick and smooth traffic operations, the roads to be taken by passengers and luggage do not cross each other. The waiting room on the first floor of the terminal building is for both arriving and departing passengers. Together with the ticket offices and administration facilities of the various airline companies, it is situated above the central customs room, adjoining which are further waiting rooms for in- and outgoing passengers. The north building contains the offices of the airport management, the central radio station and the meteorological office. The control tower is located on the roof. All rooms necessary for operational purposes —flight personnel, customs, meteorological service, and so on—are on the ground floor. The southern part of the building houses the catering facilities for meals served on board aircraft, restaurants, and has terraces overlooking the airport. Alongside the main terminal building it is intended to erect a mail and freight building for handling all goods (except passenger luggage), but this is reserved for a later constructional period.

The technical facilities at the service of scheduled airlines comprise a group of workshops for overhaul and repair work, with power plant shops equipped with a test bed, as well as the necessary hangars for housing transport aircraft. The workshop hangar, designed for seven or eight aircraft, has a door 33 feet high; covering an area of 61,185 sq. ft., it is 492 feet long (door frontage with a central support) and 123 feet wide. The roof contains the rails for a five-ton crane. Also forming part of these buildings is a double hangar which, like the workshops, it is to be built during the first constructional period and will therefore be completed by next Autumn. These hangars will be capable of housing ten to eighteen aircraft, according to type. For economic and architectural reasons, curved roof hangars, about 60 feet high, have been chosen. They are to be 213 feet long and will have an entrance width of 246 feet.

The erection of further hangars, power plant shop, office buildings, etc., as well as the buildings for feeder and private flying are reserved for a later constructional period. Also as regards these buildings, care will be taken that, should the need arise, they can be expanded or even joined together without disturbing the general working plan of the airport.



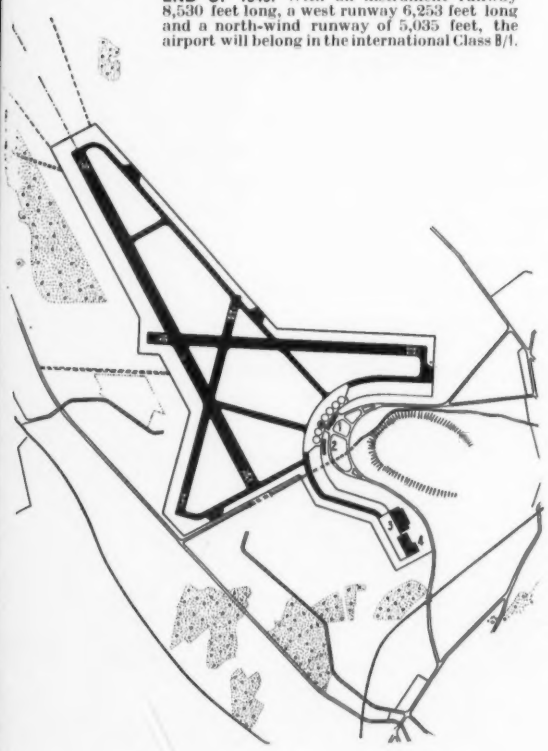
THE WORKSHOP IS DESIGNED FOR OVERHAULING and is located apart from the hangars. A five-ton crane running along the roof facilitates maintenance and disassembly work on large airliners.

All the buildings, which in their entirety form the head of the airport, are situated along an arc-shaped loading apron, which will initially be 1,150 feet long and 400 feet wide. The inside part is large enough to cope with seven four-engined airliners, and the design allows for an extension in either direction.

It was not an easy matter to select a terrain on the hilly Swiss plateau which was suitable for constructing an airport meeting with the international standards for intercontinental airports. It so happens that the ICAO regulations are very strict as regards the minimum freedom from obstacles in the approach and departure sectors. The arrangement of the instrument runway in Zurich-Kloten is free from obstacles to incoming and outgoing aeroplanes over a plane featuring an inclination of 1 in 50. The inclination of this plane for the east-west runway (10/28) amounts to 1 in 30 and even the north-wind runway, which will very seldom be used and probably never used at all for approaches in bad weather, conforms to regulations. A further proof that the Kloten area was well chosen is given by the relatively small number of obstruction warning lights, which, according to ICAO regulations, must warn of all obstructions in the vicinity of the airport. The regulation applying to Kloten is : all obstructions which, within a radius of 13,000 feet from the centre of the airport, extend above a horizontal plane lying 150 feet above the runway level, must be illuminated. The ICAO regulation goes still further : about this horizontal circular plane (radius 13,000 feet) must be imagined a conical surface mounting outwards with an inclination of 1 in 20 ; for airport classes A and B this must constitute an additional obstruction-free area up to about 3.7 miles distance from the airport, and in which eventual obstructions must also be marked. Within a radius of 4.5 miles, the highest obstructions outside Kloten airport do not extend higher than 655 feet, and not higher than 1,640 feet above runway level within a radius of 18.5 miles.

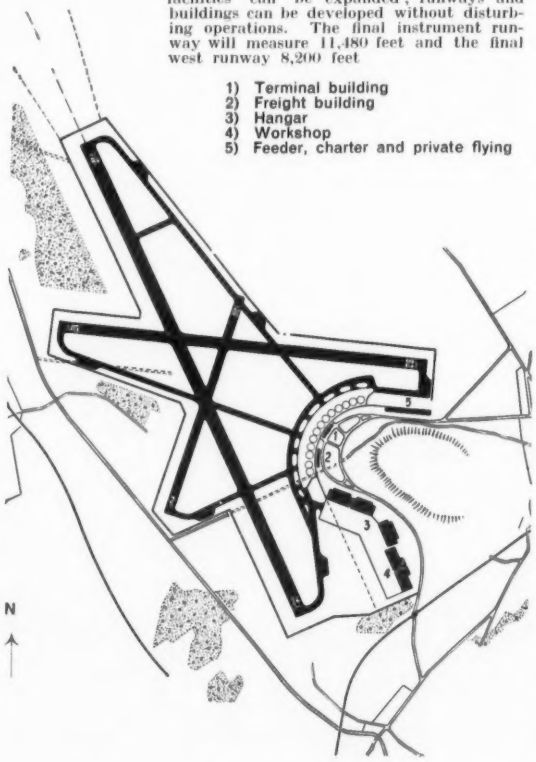
Apart from the topographical configuration of the area around Kloten, the many years of meteorological experience gained at the nearby Dubendorf airport also played a

THE FIRST CONSTRUCTIONAL STAGE OF ZURICH AIRPORT WILL BE OVER BY THE END OF 1949. With an instrument runway 8,530 feet long, a west runway 6,253 feet long and a north-wind runway of 5,035 feet, the airport will belong in the international Class B/1.



DEVELOPMENT INTO AN INTERCONTINENTAL AIRPORT OF CLASS A/1 : all facilities can be expanded ; runways and buildings can be developed without disturbing operations. The final instrument runway will measure 11,480 feet and the final west runway 8,200 feet

1) Terminal building
2) Freight building
3) Hangar
4) Workshop
5) Feeder, charter and private flying

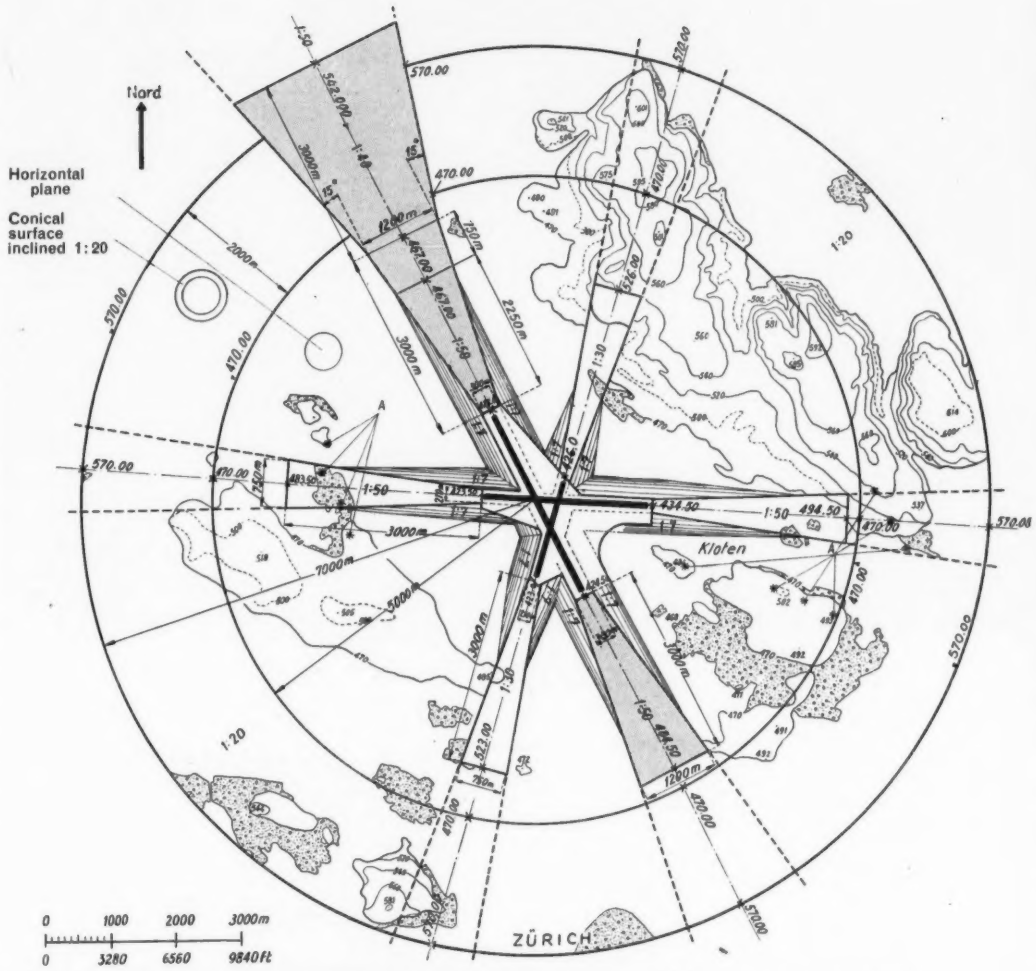


part in the selection of the site. During 32 per cent. of the observation period, average wind speeds of about 5 m.p.h. were recorded, during 3.9 per cent. of the time these averaged 11 m.p.h., and only during 0.6 per cent. of the time were wind speeds of over 15 m.p.h. recorded. Prohibitively bad weather, very low ceilings, ground mist, snowdrifts, and so forth were observed during only 6.9 per cent. of the observation time.

The main element of the runway system at Zurich-Kloten is the instrument runway, running from north to south with QDM = 159°. It measures 246 feet in width and the first 6,560 feet should be completed by next Autumn. At the end of the first constructional period, however, it will be 8,530 feet long, and 11,480 feet of runway should be at disposal when it is completely finished. Also as regards the runway system, it was constantly borne in mind that it might be necessary, at some later date, to enlarge or modify in order to meet still stricter demands. Since the international classification of an airport does not only depend on the length and width of the runways, but also on their load-bearing capacity, the subbase of the instrument runway was designed so as to be in the ICAO Class I. This means that it must be capable of bearing the pressure of a single isolated wheel amounting to 100,000 lbs.—corresponding, in the case of the present-day tricycle undercarriages, to aircraft gross weights of up to 150 tons.

The west runway (10/28), running from west to east, has the same load-bearing capacity over its length of 6,235 feet and width of 196 feet. This runway, too, is ultimately to be lengthened to 8,200 feet, since the ICAO regulations recommend that the secondary runways of an airport should have at least seventy per cent. the length of the main runway. At Kloten airport it will be possible, with these two runways, to handle all long-range airliners which are a little sensitive to weak side winds. Right from the beginning, therefore, the north end of the instrument runway and the east end of the west runway are to feature suitably-illuminated approach funnels for night and bad weather landings.

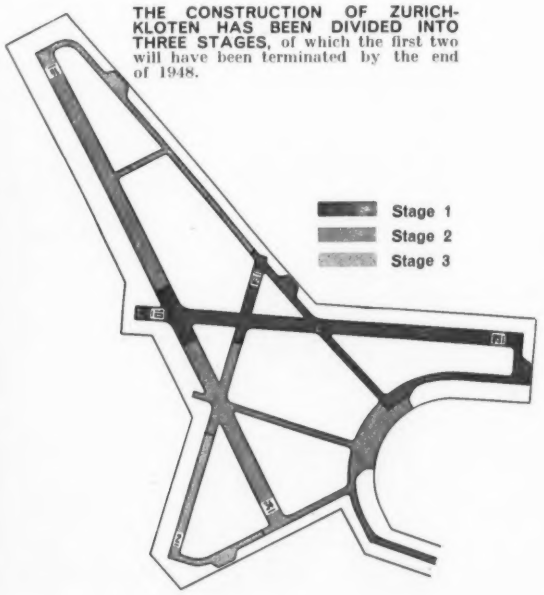
For smaller aircraft there will be a north-wind runway (2/20), of which the dimensions are restricted to a length of 5,035 feet and



FOR ASSURING FREEDOM FROM OBSTACLES IN THE VICINITY OF AN AIRPORT, ICAO uses the following system : lying horizontally at 150 feet above the centre of the airport should be imagined a circular plane of 13,000 feet radius, adjointed by a conical surface sloping outwards with an inclination of 1 in 20. All natural obstacles extending beyond these planes are regarded as hazards to safe flying and are consequently to be marked by red hazard beacons. The unobstructed take-off and approach funnels have inclinations of 1 in 50 (instrument runway) and 1 in 30 for the other runways. The hazard beacons in the vicinity of Zurich-Kloten airport are shown here by (A).

WORK ACCOMPLISHED BY SPRING, 1948. West runway and north-wind runway are nearly completed ; the instrument runway (in the foreground) is still under construction.

THE CONSTRUCTION OF ZURICH-KLOTEN HAS BEEN DIVIDED INTO THREE STAGES, of which the first two will have been terminated by the end of 1948.

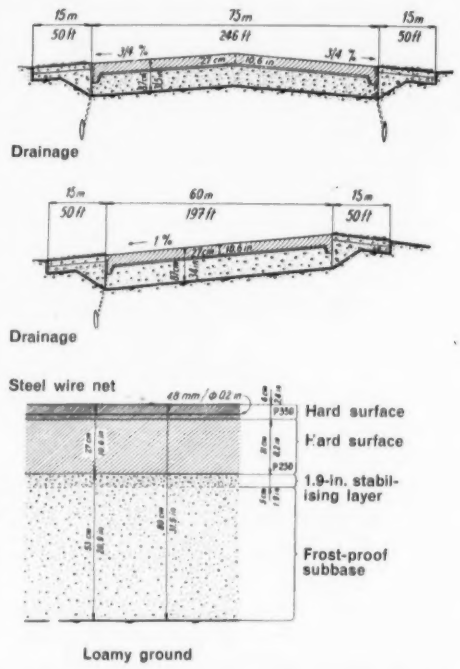


THE GRAVEL PIT FOR ZURICH-KLOTEN is right in the airport area. In the background can be seen the gravel plant of Bless & Co., Zurich, the firm entrusted with all excavation and processing of constructional materials.

a width of 148 feet ; its load-bearing capacity is designed for aircraft of up to 55 tons gross weight. Alongside all runways are lateral strips of 50 feet width, enabling aircraft to taxi on either side of the runway, whereas the remaining airport terrain is not suitable for taxi-ing.

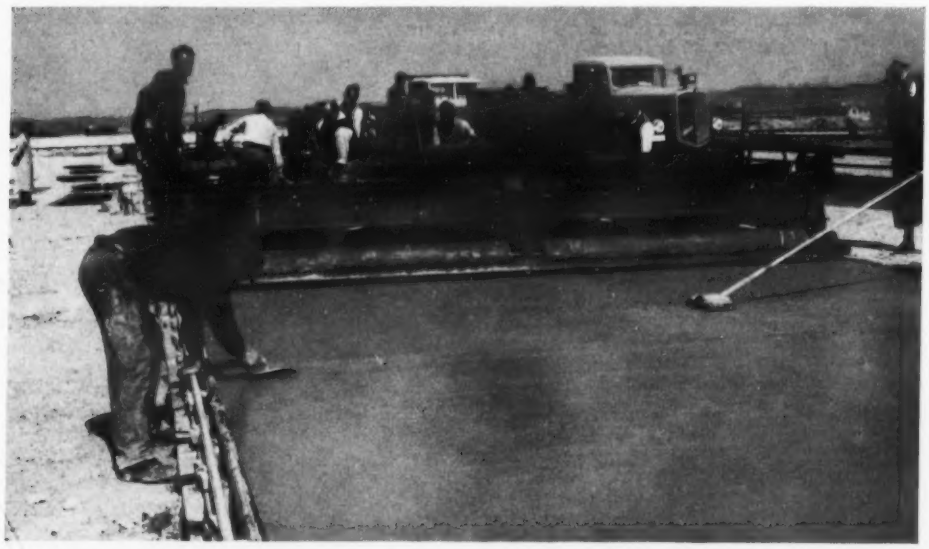
In view of the runway disposition, therefore, Zurich-Kloten can be internationally classified as a Class B/1 airport. This denotes that, as regards runway length, the airport belongs in the second-highest class, and with regard to load-bearing capacity, in the highest class. In this way it will be possible, at any time, to expand Zurich airport so as to bring it into the top class, A/1, of intercontinental airports, merely by lengthening the two main runways, and without interrupting or placing any restriction on operations.

The soil conditions on the airport site were rather unfavourable, and the ground had to be excavated to a depth of 2.6 feet below runway level and replaced with frost-free, well-sealed gravel and sand materials. The dimensioning of the concrete surfaces required complicated tests and the erection



BAD SOIL CONDITIONS NECESSITATED EXTENSIVE SUBBASE WORK in order that the runways could withstand wheel pressures of up to 100,000 lbs. (less for the north-wind runway). The west runway (inclination of 1 per cent., width of 196 feet) slopes sideways in profile, whereas the instrument runway (inclination of $^3/_4$ per cent., width of 246 feet) features a roof-type section.

THE 10.6 INCH CONCRETE SURFACE was prepared with equipment similar to that used for building roads.



of a small trial runway. This careful preparatory work proved its worth, however, as the examinations conducted afterwards gave very satisfactory results and confirmed the calculations in every way. The hard surface for all runways consists of a 10.5-inch concrete layer. The concrete surface, concerning which thorough tests were made in order to find the most advantageous composition (this will be discussed in one of the next issues of Interavia Review), has been made as smooth as possible. Additionally, in order to avoid confusion with the taxiways, they are bright in colour. To facilitate take-offs, the instrument runway has transverse lines marking the runway in thirds, and the axes of the west and north-wind runways are shown by a painted centre line. The longitudinal inclination is very small for all runways, barely reaching one-half per cent. (according to ICAO regulations, the longitudinal inclination may go up to one per cent.). Also the lateral inclination of the runways conforms to ICAO standards, attaining between three-quarters and one per cent. The instrument runway features a roof-type section, whereas the west and north-wind runways incline on one side only.

In the planning of the taxiways between runways and apron, account was largely taken of the experience gained on modern U.S. airports. In order to obtain simple and unobstructed taxi operations, the ends of all runways are connected by taxiways with the apron in the most direct manner possible. At the same time care has been taken not to have the taxiways running parallel to the runways ; and, moreover, the taxiways are darker in colour than the runways, so that there is very little possibility of confusion. At the extremities of the runways, at the side of the taxiways, are running-up aprons where pilots can give their engines a final check before taking off.

The organisation of the constructional programme and the placing of the building contracts was not an easy matter, since the size of the project precluded its execution by one single firm. The top supervision was entrusted to Mr. H. Strickler, of the firm of Locher & Co., from Zurich ; other participant firms were : Baumann, Koelliker & Co., Zurich (electrical installations) ; Max Bärlocher, Zurich (drainage) ; A. G. Heinr. Hatt-Haller, H. Gossweiler & Co., Losinger & Co. S. A. and Stuag S. A., Zurich (concrete runways and reinforced concrete for workshops) ; Walo Bertschinger A. G., S. A. Conrad Zschokke, Ed. Zublin & Cie. S. A., Zurich (concrete runways) ; Schafir & Mugglin A. G., Zurich, Kibag A. G., Zurich, Hoch- und Tiefbau A. G., Aarau, Frutiger Söhne & Cie. Thun (subbase work, canalisations and concrete runways). The large quantity of gravel material which was necessary was obtained by digging up a hill

in the vicinity of the head of the airport; the firm of Bless & Co., of Zurich, was entrusted with excavating and processing the gravel.

Zurich-Kloten airport is being opened to airline operations this month. Initially, the traffic density will not be very high, as only the 6,235-foot west runway will be available during the first few months. By next Autumn, however, the 6,560-foot instrument runway will be ready for use, and by the end of 1949 the airport's first constructional stage will have been terminated.

The careful planning and the desire to keep the airport well up to the requirements of modern commercial aviation by maintaining constant close contact with U.S. aviation circles, have resulted in an installation at Zurich which will doubtlessly strengthen Switzerland's position among the European airfaring countries.

CONSTRUCTION WORK EXECUTED SO FAR. The added extensions indicate the work which still remains to be carried out.

Radio Installations

By H. Brechbühler, Technical Chief of the Airway Traffic Control Service, Radio-Suisse S. A., Berne.

Although the general public has invariably been keenly interested in airline safety questions, the interest shown by the industrial concerns connected with these problems has always been enormous. In this respect, the radio installations, both on the ground and in the aircraft, are of specially great significance today. If we were to compare the equipment of a modern airport with that of a prewar air base, we would soon discover that the importance of the technical aspects has multiplied many times over. However, we would simultaneously find out, to the detriment of efficient airway control, that there is very much less standardisation of operational methods in Europe than before the War. Instead—and notwithstanding international recommendations—a whole variety of wartime developments has been put into service, certain of which do not conform to ICAO standards. At present we are in a period of transition, changing from the earlier European to the now primarily American systems of airway and airport traffic control.

It will be plain from the above that these circumstances had to be considered very carefully in the planning of the radio installations at Zurich-Kloten airport. It will also be readily understood that this resulted in considerably more expensive installations. These expenses are nevertheless well justified, since they concern nothing less than the safety of national and international airline operations.

A high degree of regularity in present-day civil aviation no longer depends only on the airline companies, but equally as much on the reliability and efficiency of the technical installations. The urge for increasing mechanisation brings the technical aspects ever more to the foreground. With these considerations in mind, Radio-Suisse S.A., under contract to the Federal Air Office and the Canton of Zurich, has endeavoured to provide Kloten with the best and most suitable equipment.

Aviation Radio Central

From the standpoint of airway control, Kloten occupies a special place among Swiss airports because, owing to operational and technical reasons, it is to incorporate the Aviation Radio Central. Though this central is still at Dubendorf, it will be transferred to Kloten this Autumn, and later installed in the finished administration building. It will provide meteorological services and communications with domestic and foreign airfields. In addition to a teleprinter central, to be designed according to the latest ideas, the radio central will have a full equipment of radio receivers and control panels for remote-controlled transmitters. Because there are too many parasites, it will not be possible to install the receivers in the administration building. They will be set up in the direction-finding building and controlled from the administration building via remote systems as well as cables.

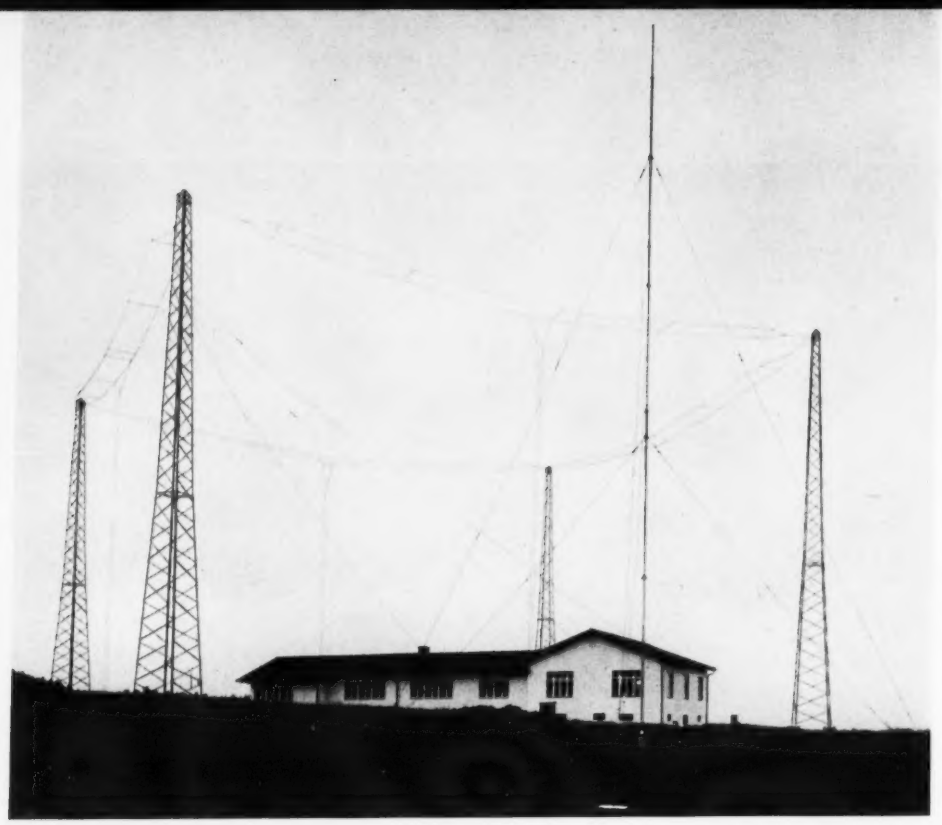
Waltikon Transmitting Station

The airport construction plan required that the transmitting station in Kloten be transferred and partly rebuilt, this for flight-technical and radio-technical reasons. In its place a new transmitter has been built at Waltikon, on the Zurichberg (approx. ten miles S.S.E. of Kloten), and put into operation at the end of last March. It incorporates all the advantages which one can expect of an up-to-date transmitting station. At the time of writing this building houses the following transmitting sets:

Meteorological Service
1 MF transmitter
4 HF transmitters

Ground Communications (Traffic)
1 HF double transmitter
6 HF transmitters

Further equipment is in preparation.



THE WALTIKON TRANSMITTING STATION contains all the airport transmitters. In the foreground can be seen one of the twelve HF vertical antennæ and in the background the four masts for the LF antenna system.

Aircraft Communications

4 HF transmitters
3 MF transmitters
1 VHF transmitter (in preparation)

In order to avoid complicated antenna feeds, all the new transmitters are connected with the antennæ via subterranean HF feed cables. A commutation system enables them to be interchanged at will. As regards antennæ, vertical radiators are utilised for the HF communications, and " T " antennæ for the MF transmitters.

All transmitters are fitted for remote-control and remote-keying. Thanks to two central, six-channel transmitters, working on audio frequencies, which were specially built for the purpose by Radio-Suisse, they can be entirely remote-controlled via two Post Office lines from Dubendorf, Kloten and Oberglatt. Utilisation of this pattern of transmission equipment results not only in great economies as regards cable leads, but also provides technical advantages. For instance, the usual anti-parasite procedure for keys and switches when d-c current is used is no longer necessary here, since low a-c tensions and audio frequencies are utilised.

In order that the entire station may immediately be switched over to emergency current operation in the case of a breakdown, the cellar contains a 90 KVA emergency generator group, with Diesel drive and automatic starter.

D/F and Receiver Station at Oberglatt

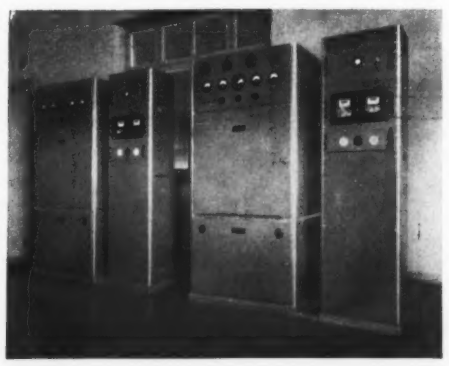
Until such time as a wide-spread technical organisation for medium-range navigation and approach procedure (after the pattern of ICAO VHF Omni-Ranges and ILS 2) has been introduced, MF ground direction-finding will be continued to be used in Europe. This system will be supplemented by the acquisition of an automatic VHF direction-finder, practically free from atmospheric influences and night errors. The direction indication, without inertia, is reproduced on the screen of a cathode-ray tube. In this way, D/F intelligence can be read off continually, at the same time as the aircraft is in voice communication with the ground. At the same time as indications appear on the main set in the D/F building, a remote indicator enables the D/F results to be shown in the same manner, without inertia, in the control tower. In addition to the present communication methods for ground-to-aircraft telegraphy, VHF transmitter-receivers are being introduced for communications in the approach area. The three MF D/F and receiver sets at present being used in Kloten will continue to be used at Oberglatt after the D/F station at Dubendorf has been stopped. The afore-mentioned remote-controlled receiver sets will later be housed in the same building. The location of the D/F and receiver station is dictated by the position of the blind-landing axis, and it must moreover be in a zone which is free from atmospheric disturbances. In the case of Zurich airport, these conditions can be fulfilled in the best conceivable way, since the building in question can be erected in the vicinity of Oberglatt, in a region entirely free from parasites.

Control Tower

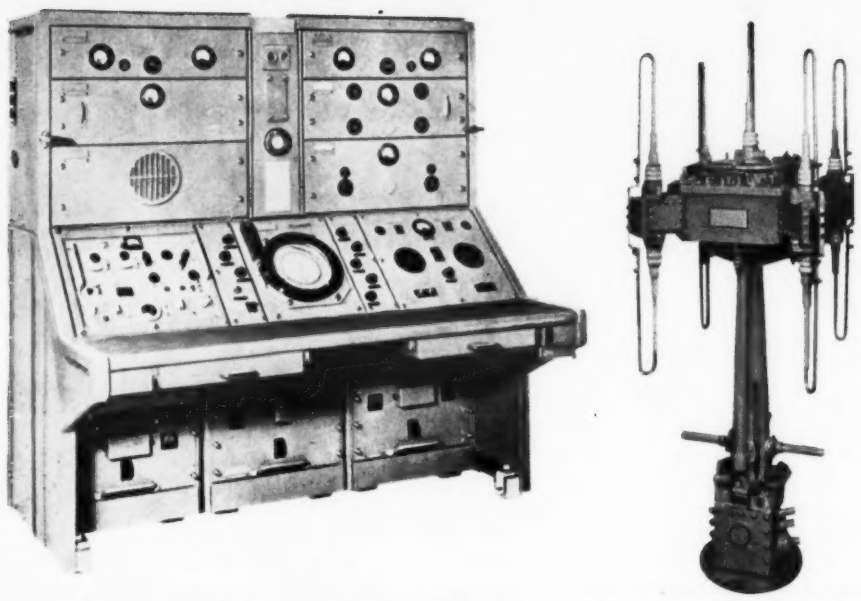
Pending completion of the final administration building, a provisional control tower is being put into operation. For the time being its radio equipment comprises an HF set and two VHF transmitter-receivers for telephonic communication with aircraft in the approach area. Moreover, the aforementioned remote indicator for the VHF D/F set is also housed in the control tower. In addition to the control desk for operating the landing lights, that for the instrument landing system, with its checking instruments, is also being installed in the control tower, in order to achieve useful centralisa-

THE HF TRANSMITTERS (built by Brown-Boveri, Baden) in the transmitting room at the Waltikon radio station.

THE MF TRANSMITTERS at Waltikon have built-in remote-control (built by Peravia, Berne).



VOICE COMMUNICATIONS BETWEEN GROUND STATION AND AIRCRAFT are registered by Dictaphones.



IMMEDIATE TRANSFER OF D/F INTELLIGENCE TO AIRCRAFT is of great importance to smooth landing approaches. Zurich-Kloten airport is therefore fitted with an automatic VHF D/F set (built by Standard Telephones and Cables, Ltd.). On the right can be seen the D/F antenna system.

tion. So that all voice communications between aircraft and ground station may be registered, Dictaphone sets are installed; and, should the need arise, these messages can be reproduced at a later date.

Blind Landing Systems

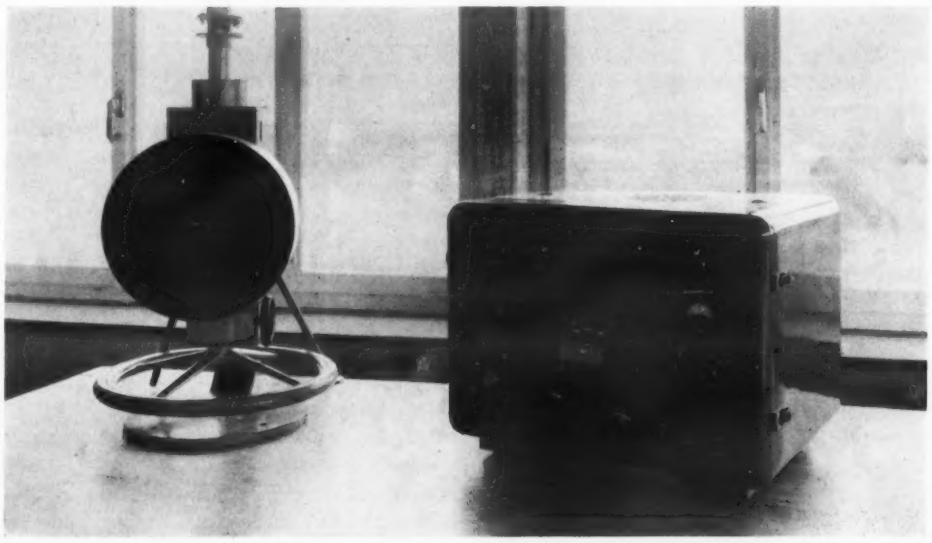
Two landing systems, embodying different principles of operation, are at present in wide use in Europe. These are the old Lorenz system, also known as SBA (Standard Beam Approach), which works on a frequency of 33.3 Mc/s, and the American SCS 51 system which, presupposing advantageous location and terrain conditions, gives more exact indications. Both systems are to be installed at Kloten, and the civil version of the SCS 51 system, known as ILS 2, will be erected this summer. After civil operations have been stopped at Dubendorf airport, the equipment there (modified Lorenz set) will be transferred to Kloten.

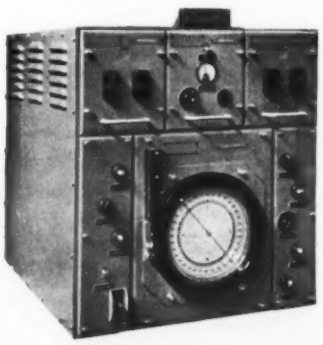
Radio Beacons

An omni-directional beacon, located near Trasadingen, on the approach beam, was put into service in August of last year. A 158-foot-high mast serves as transmitting antenna. The servicing and supervision of the 500-watt transmitter is carried out direct from the D/F building via a Post Office line. Further small beacons and VHF marker beacons, for limiting the stacking space, will be erected during the course of the summer.

The above paragraphs are only meant to give an idea of the present stage reached with the radio installations at Zurich airport. It may be concluded from the opening sentences that, although great efforts are being made to standardise working methods and equipment, the final goal has not been reached by a long chalk. As in other spheres which call for international standardisation, here, too, the main obstacles are political and economic differences of opinion between the nations. To a certain extent, it is the enormous purchase and operational costs of up-to-date radio equipment for airway and airport traffic control—take for example the GCA system—that have obstructed its adoption in many countries. For these reasons, it is almost impossible to start, years in advance, on definite projects for airway traffic control. The main objective should rather be carefully to watch the overall development and, when new acquisitions are necessary, to adhere as closely as possible to the ICAO recommendations. It is in this way that we can best contribute towards the standardisation we all desire.

INSIDE THE D/F AND RECEIVER STATION are three "Peravia" D/F sets (90—4,000 m. wavelength).





INDICATIONS FROM THE AUTOMATIC D/F SET are repeated on a remote-indicating apparatus in the control tower.

Airway and Airport Traffic Control

By A. Fischer, B.Sc., Zurich

Foreigners generally regard Switzerland as the country of mountains, picturesque valleys, and lakes surrounded by high peaks —a paradise for winter sports and mountain tours.

The pilots of big airlines and charter carriers, however, are apt to look at the uneven topography of Switzerland through spectacles of a different hue. They know that the new Zurich airport is situated on the relatively " flat " Swiss plateau and, to their further peace of mind, they have been informed that the ICAO regulations on freedom from obstructions have, as a matter of course, been very strictly observed. But despite this, the further-distant hilly surroundings of the airport require an extremely carefully planned approach system and a very precise functioning of the airway traffic control service.

The organisation of the airway traffic control service was based on two fundamental considerations : on the one hand it was thought to equip Zurich airport with as many navigational aids as possible, which would be utilisable at present and in the near future, in order to be able to give service to aircraft equipped with the widest variety of radio equipment ; on the other hand, it should be possible to satisfy the demands of a very high traffic density. (In theory the installations at the new airport allow for peak operations of one landing or one take-off every two minutes.) As a first measure towards achieving this goal, the Swiss Federal Air Office and the Canton of Zurich, as constructors of the airport, decided on two radical changes in the airway traffic control procedure hitherto used in Switzerland : on the one hand to introduce telephony as a means of communication between aircraft and ground and, on the other hand, to transfer the entire airway traffic control service to one single organisation, the 50 per cent. state-owned Radio-Suisse S. A. This meant following a path which had been taken a long time ago in other countries. The fact that radio telephony is only now being introduced in Switzerland as the best means of communication between aircraft and ground, is because Swiss civil aviation was almost entirely at a standstill during the last war ; and when peace came again, the Swiss had no choice but to restart with the 1939 methods.

Radio Installations

Constructors of airports would find it easier to select suitable radio aids to navigation if the process of standardising aircraft radio equipment were more advanced. For the time being, unfortunately, this still appears to be no more than a cherished desire, despite ICAO's efforts. The solution of the problem must, therefore, become a compromise between the desire to place at disposal the greatest possible number and variety of navigational aids, and a careful consideration of the size of the investments, which should not exceed a certain maximum.

At least from the quantitative standpoint, the selection of the radio installations at Zurich airport was dictated by meteorological characteristics. Long years of experience have shown, namely, that it is altogether sufficient to equip only one runway with the necessary instruments for blind approaches, since the worst conditions of visibility are invariably coupled with no-wind conditions. As soon as the wind attains a strength prohibiting landings on the instrument runway, then there is sufficient ceiling for a pilot, after he has pierced the lowest cloud layer, easily to fly around the airport and select a runway on which he can land under suitable wind conditions. This fact is due to the topographical configuration of the airport surroundings, and is so pronounced that it is perfectly safe to risk using only one side of the instrument runway for approaches, namely the topographically-favourable side from the NNW direction (QDM 159). It is for this reason that the radio installations are particularly concentrated in the direction of the NNW-SSE runway. The most important features in this area are the beam of an SBA landing beacon, with its two boundary signals, and the transmitting equipment of the American ILS 2, with localiser, glide-path, and three marker beacons. It might be mentioned here that, in view of the installation of both these landing systems, the never-ending controversy—SBA or ILS ?—will at least not arise in Zurich.

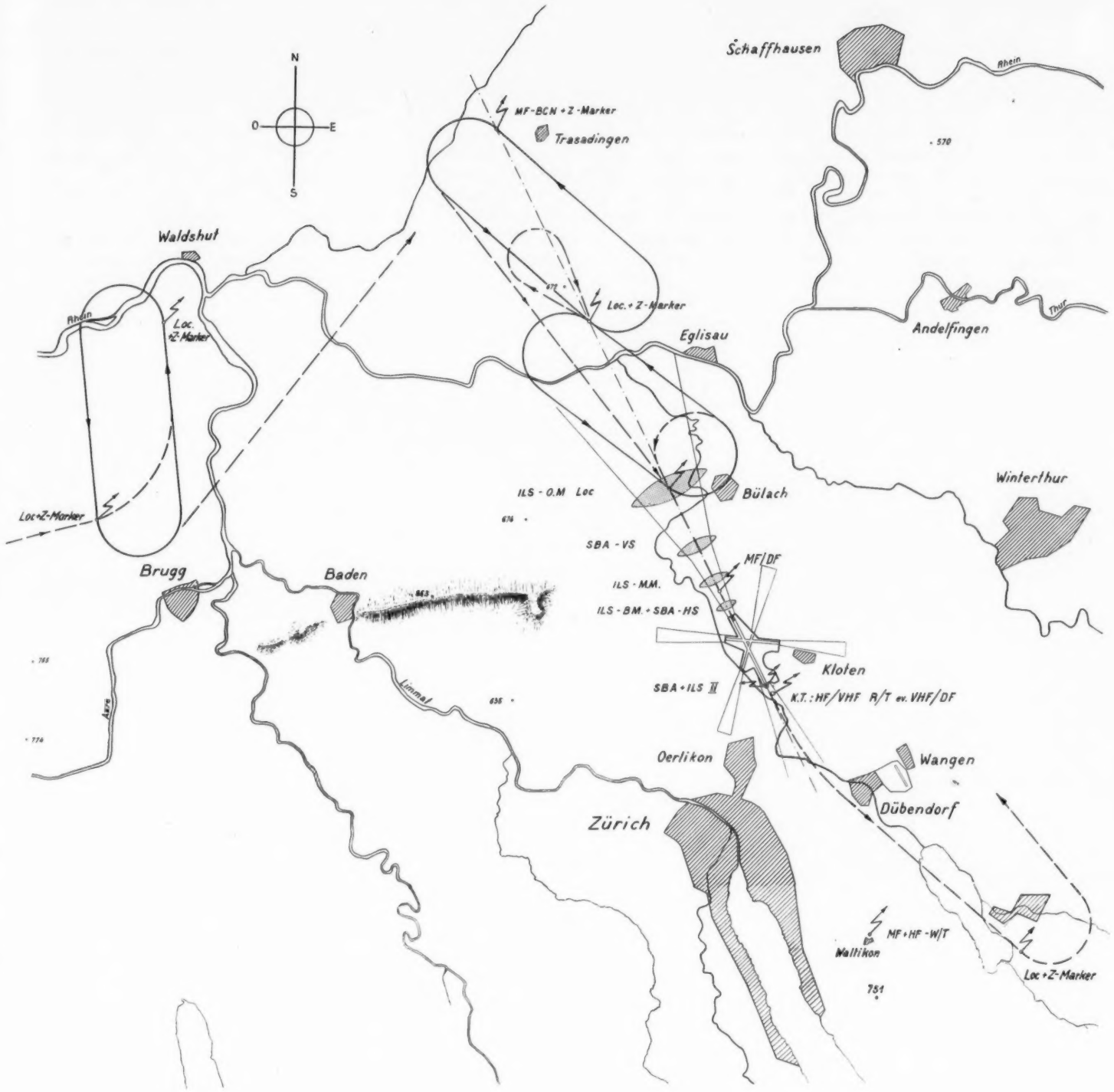
It also seemed natural to place the MF D/F landing beacon at the NNW end of the instrument runway. Its position (47°28'50" N /8° 31' 57" E) is all the same—for reasons which will be mentioned later on—about 3,500 yards from the runway threshold. From the operational point of view this should be quite suitable, particularly when one recalls that QDM, as a navigational aid for blind approaches, is only of limited importance, since it can only be used if the ceiling is sufficiently high to permit a contact flight to the runway after flying over the D/F beacon. The station housing the D/F beacon incidentally serves two other purposes. It houses the area control equipment, and furthermore contains all the telegraphy receivers (remote-controlled) of the meteorological service and all the equipment for ground communications.

At the southern end of this chain of radio installations, at about eight miles from the end of the instrument runway, is the likewise remote-controlled Waltikon transmitting station (47° 20' 23" N /8° 36' 53" E). All telegraphy transmitters, over which are transmitted reports and orders from the area control centre, the D/F station and the meteorological and communications service, are grouped together in this transmitting station.

In the north area are two smaller transmitting stations, which serve as compass locaters for defining the stacking spaces, and finally, about 15 miles distance from the runway threshold, the 400-watt Trasadingen beacon (47° 40' 24" N/8° 24' 43" E), which sends out the radio signal HEZ-HEZ once a minute on the frequency 3,555, 5 Mc/s.

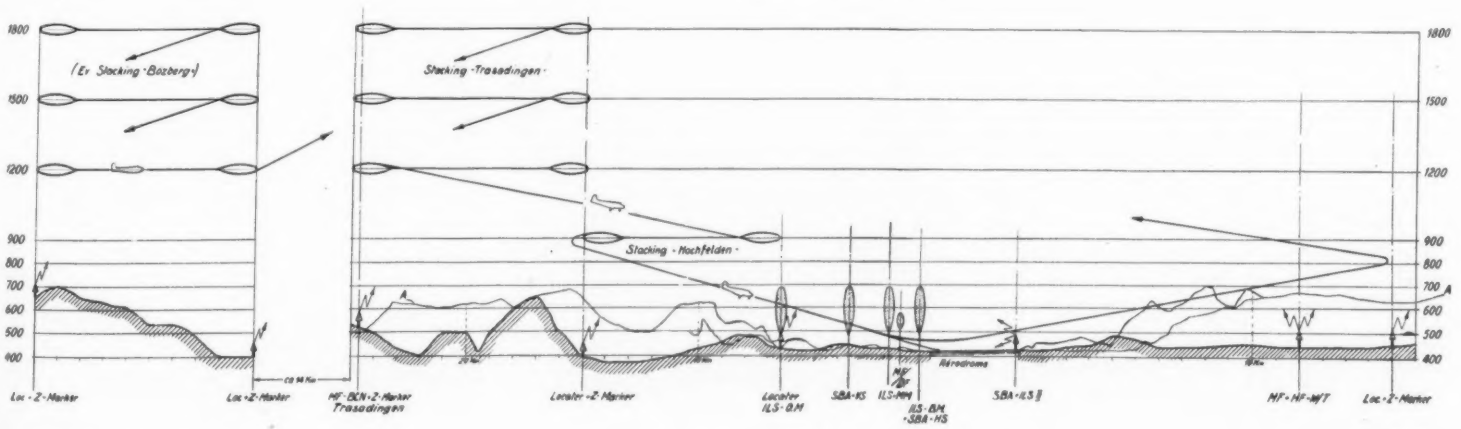
Of the remaining installations, which are no longer positioned on the afore-mentioned straight line, mention may be made of the three most important ones. The control tower, which controls traffic in the immediate vicinity of the airport, and which, pending completion of the main building, is temporarily erected in the centre of the runway system, utilises VHF and HF telegraphy on the usual frequencies. Furthermore, the control tower is to be equipped with a VHF D/F set, working without inertia, and of which the antenna system will be located in the approach funnel. In this way it will be possible to give aircraft fitted with only two-way VHF telephony equipment, exact bearings for an approach.

Studies for a method to control the distance of incoming aircraft from the runway threshold gave birth to the idea of the off-course D/F beacon. The D/F hut will



THE APPROACH PROCEDURE IN INSTRUMENT WEATHER IS CLEAR FROM THIS DIAGRAM.

A medium-frequency beacon with marker (MF–BCN + Z-Marker), which simultaneously forms a boundary to the first stacking space, is located at Trasadingen, in the approach funnel. The second stacking space is positioned between two locaters at Eglisau and Bülach. The radio signals for instrument approaches are likewise on the approach axis; the outer ILS marker (ILS–O.M.), then the middle and boundary markers (ILS–M.M. and ILS–B.M.). The markers for the SBA system are similarly distributed (SBA–VS and SBA–HS); the directional transmitters of both systems are installed at the southern end of the instrument runway. The control tower (K.T.) is equipped for high- und very-high-frequency telephony (HF/VHF R/T) and has an automatic VHF D/F beacon. A beacon for departing aircraft is located at the southern end of the Greifensee; MF and HF transmitters are grouped in the Waltikon station. It is planned to establish an additional stacking space at Bötzberg, in the area between Waldshut and Brugg.



be situated at about three miles to the side of the approach funnel. It was originally planned to make this MF D/F beacon fully automatic, so that its results could be transferred to the head D/F station without the need for service personnel. Meanwhile, however, the idea has now been dropped owing to insurmountable difficulties with regard to the automatic remote transmission, and it has now been decided to have a manned D/F beacon, using the ordinary method of transmitting D/F intelligence to the D/F landing beacon by telephone or VHF transmitter.

In conclusion may be mentioned the cable and teleprinter connections, which it was originally planned, for the duration of the provisional stage, to lead only as far as the present building in Dubendorf. In the meantime, however, it has been discovered that the cable connections, especially those for developing the meteorological service, must be multiplied. It is therefore being considered at present whether the cable and teleprinter service should not also be put into a temporary structure at Kloten. The final plans of course provide for the installation of all these facilities in the main building.

In order to avoid any confusion from the start, it is emphasised that the majority of radio installations mentioned here will only be set up during the course of this summer, and will therefore not be ready for service before late Autumn, by which time all operations will have been transferred from the old airport at Dubendorf to the new facilities at Kloten. During the summer months of this year, over which period this new airport may only be flown to by aircraft which cannot land at Dubendorf, use must be made of the aids which are also utilised by Dubendorf (Trasadingen radio beacon, Lorenz landing beacon). In addition, the following installations will be put into service specially for Kloten : the new MF D/F station, and the control tower equipped with VHF and HF telephony.

Radio Range and Radar Installations

The erection of a radio range installation was minutely examined and—at least for the present—not approved of. Various reasons were involved. Apart from a number of doubts as to whether a radio range transmitter could be made to function reliably across the hilly Swiss terrain (attempts to decide this are being undertaken), no clear idea was reached as to what nature of radio range should eventually be erected. Quite apart from the temporary difficulties as regards acquisition, the moment for installing an omni-directional VHF radio range, as recommended by ICAO for the future, did not seem ripe for the time being. A good enough reason for this opinion is that only very few aircraft in scheduled service are already fitted with the necessary airborne equipment. The VHF four-arm radio range, on the other hand, only seems to be a transitional system, which is likely to be surpassed by the omni-directional VHF radio range. And it is probably safe to assume that the developments in Europe will probably bypass the VHF four-arm radio range altogether. The still available low-frequency radio range, which is not susceptible to night errors and can be used by practically all aircraft, is probably, for well-known reasons, on the way out. Furthermore, its extensive antenna set-up is so costly that one is compelled to ask oneself whether it is really worth while installing equipment which is certain to be out of date before long.

After mature consideration, therefore, it was decided to delay the erection of radio ranges until this complex problem was a little more clarified, but to replace the indisputable navigational and operational advantages of the radio range system with a network of radio beacons and compass locaters, the nature of which is described further on.

Similar conclusions were reached as regards the question of radar installations. Once again the hilly topography of the area around Zurich airport gave rise to queries as to whether the fully reliable operation of radar systems would not be limited. The conviction was reached that it would be necessary first to conduct very thorough experiments before deciding on the extremely expensive acquisition of radar equipment. At all events GCA (Ground Controlled Approach) is well at the top of the list in this connection.

Airport Traffic Control

According to general practice today, airport traffic control is divided into area control and local control. Though both controls are physically separated from each other, great value has been attached to good communications between them.

Area control has at its disposal three HF transmitter and receiver sets for aircraft-ground communications over long distances (transmitting power : 300 watts each ; frequencies : 3,989, 6,577 and 11,394 Mc/s) and two MF D/F sets for small distances, working in the usual frequency range. Local control, which under IFR (Instrument Flight Rules) conditions, is divided into approach control (APP) and aerodrome control (ADC), possesses the already-described equipment of the control tower, the landing- and off-course D/F beacons. One novelty is a method by which aircraft desiring to approach by QDM can obtain D/F values and their distance from the runway threshold through a special VHF telephony channel. It is to be assumed that this method will enable considerably more D/F results to be transmitted per unit of time than hitherto, since the D/F procedure need no longer be interrupted by the telegraphic transmission of the results.

Approach control at Zurich airport is faced with problems which perhaps arise only to a lesser extent at other airports. The most difficult one is due to the circumstance that, in the stacking areas, where aircraft are orbitting at prescribed levels, awaiting their QGP 1 (Q code for " your turn to land is No. 1 "), there are ground elevations which, in the absence of countermeasures, would require that aircraft stack rather high. This is undesirable for two reasons, first because the icing levels are reached all too quickly, and second because of the time lost during the descent to the airport, which slows down the landing sequence.

In order to avoid these disadvantages, there are to be three separate stacking spaces, each marked off by two locaters and provided with Z-markers for giving exact positions. The nearest one to the airport is the Hochfelden stacking space ; the locater marking off the stack towards the airport is about 3.7 miles from the runway threshold, and the second locater about 7.4 miles. Between these locaters it is possible to orbit at a minimum altitude of 2,950 feet above sea level, or 1,575 feet above runway level. Adjoining the Hochfelden area is the main stacking space, which is located between the Trasadingen radio beacon (soon also to be supplemented by a Z-marker) and a locater positioned 7.4 miles from the runway threshold. The two transmitters are about five miles distant from each other. The minimum orbitting altitude in this stacking space is 3,940 feet above sea level (2,560 feet above airport level), as five miles north-east is a hill attaining 2,950 feet above sea level.

The procedure is now clear. Stacking in the main Trasadingen area, of which the centre is about nine miles from the runway threshold, starts at 3,940 feet above sea level. In order to accelerate the landing sequence, the aircraft which has received its QGP 2 will be drawn into the nearest-located stacking space during the approach of the QGP 1 aircraft, in that it is immediately ordered to come down to 2,950 feet. Despite this measure, however, the QGP 5 aircraft, for instance, would still have to be kept at an altitude of 6,890 feet. In order to avoid high altitudes of this order, it is intended to organise a further stacking space in the area west of the lower Aare course, about ten miles southwest of the Trasadingen beacon, in which a parallel stack can be built up. The intention is that all aircraft coming from a broad west direction should first be guided into this space and then allowed to occupy only the lowest levels of the Trasadingen area. It must be said that the final solution is still under study, and will not come into execution before the traffic density at the airport increases to such an extent that aircraft start stacking too high in the main area. At least as regards the initial operations, this is not to be expected.

Special problems will arise in the handling of aircraft approaching, over the Alps, from the south and southeast of Zurich airport. It is evident that it will only be possible to exercise regular control over traffic of this sort when we have succeeded in placing exact boundaries on the Alps, by means of radio ranges, for instance, or other navigational systems.

For the benefit of aircraft taking off, or aircraft which have misjudged their approach to the airport, there is to be an additional locater with a Z-marker at the east end of the Greifensee, thus on the opposite side of the approach funnel. Its position will be about nine miles from the end of the runway and somewhat to the left of the continuation of the ideal approach direction. The reason for the last measure is to keep aircraft away from the Zurichberg ridge, which lies above airport level. Once an aircraft has reached this fixed point, it can return again to the beginning of the approach area by curving northwards at a safe altitude.

(The exact positions of the compass locaters, and consequently of the stacking spaces, which will fix the final details of the let-down procedure described here, still remain to be established by the Federal Air Office.)

A further traffic control problem which remains to be solved is presented by the relative proximity of the old airport of Dubendorf, which is to continue as an air corps base. It is true that the Federal Air Office has established a boundary zone between the two airports, which should not be entered from either side even if the weather is good, and has also marked out an orbit leading around Dubendorf for aircraft requiring a long straight approach line. But it still remains for experience to show whether it will not be necessary to have a joint traffic control service for both airports. It seems at least inevitable that, in instrument flying weather, control over military traffic around Dubendorf will have to co-operate closely with that for civilian traffic around Kloten; and measures to further this end are now being studied.

Finally, the intense lightplane traffic in the vicinity of the town of Zurich gives rise to a rather special problem, since only very few of these aircraft are equipped with radio. In this connection, too, it is intended to introduce radical modifications of the procedures hitherto used at Dubendorf.

Airport Lighting

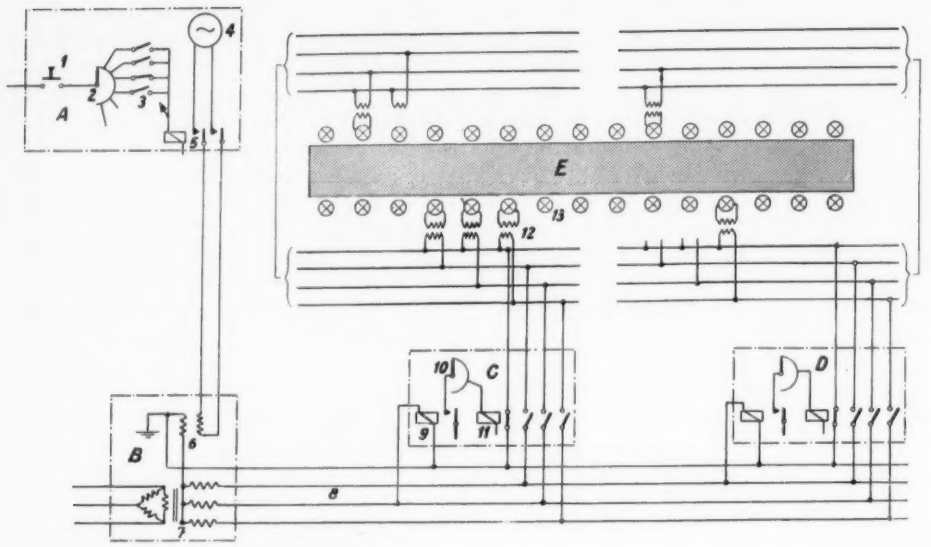
The aviation radio facilities available today are to be considered primarily as aids to navigation. They are capable of leading a distant aircraft to a point near to the airport and of controlling the approach towards the instrument runway. The actual landing, however, still cannot be accomplished by means of instruments, so that the pilot requires optical aids for the final touchdown at night or under conditions of poor visibility.

The selection of lighting equipment installed at or planned for Zurich-Kloten airport was dictated by the international standards established by ICAO. The boundary lights for runways 10/28 and 2/20 presented no special problem, since plenty of reliable data were available from abroad. Lighting units, standing about 27 inches high, are located at intervals of 165 feet on either side of the runway (10 feet outside the concrete surface), giving off a yellow diffused light along the first and last 1,480 feet of the track, and a white diffused light along the centre portion. The beginning and end of the runway is indicated to the incoming pilot by a traversing row of lights fitted with green filters. In order to avoid confusion with the taxiways, the latter are made recognisable by blue lights mounted on either side at intervals of 98 feet. The lights intended for the instrument runway are what are known as high-intensity lights, after the pattern of those manufactured in the U.S.A. by Line Material Co. (Bartow Lighting Units) and Westinghouse Electric Corp. By means of strong concentration of the beams, such lighting units enable intensities of up to 500,000 candlepower to be obtained.

GREEN ARROWS BUILT UP FROM NEON ELEMENTS indicate that the instrument and west runways are clear for taking-off or landing.

The approach funnel and the instrument runway are made recognisable by American high-intensity lighting units. Left, Westinghouse system; right, Bartow system. For blind approaches the suitability of krypton flashlights is also being examined.

For marking the approach funnels to the instrument runway, there is to be a row of lights running in a northerly direction, parallel to and 25 feet to the left of the extension of the runway centre-line. The units along this light row will be spaced at varying intervals: near to the runway are to be sixteen lamps at intervals of 75 feet, followed by twenty at intervals of 50 feet, and, at the farthest end of the row, thirty-six lamps spaced at 25 feet apart. As lights for this approach funnel, the suitability of American krypton flashlights is being examined, with which very bright lightning-like flashes with intensities of up to 7,700,000 international candles/sq.in. are attained. Until this question has been decided, however, it is probable that the instrument approach funnel will be marked out by high-intensity lighting units, similar to those used for the



WIRING DIAGRAM OF LIGHTING SYSTEM

A Transmitter
B Transformer station
C Audio-frequency receiver, switch station for west area of west runway
D Audio-frequency receiver, switch station for east area of west runway
1 Release button
2 Selector of transmitter
3 Selector switch for control desk
4 Audio-frequency generator
5 Transmitter switch
6 Feed transformer
7 Network transformer
8 Feed conduct to lighting system, 3 x 500 volts - Earth
9 Resonance relay
10 Selector of receiver
11 Power relay
12 Transformer for runway light, 290/24 volts
13 Runway lighting unit

instrument runway. For facilitating approaches from the east towards runway 10/28, a double row of high-intensity units, mounted on supports and at intervals of 164 feet, is to be erected up to a point 1,644 feet away from the runway threshold.

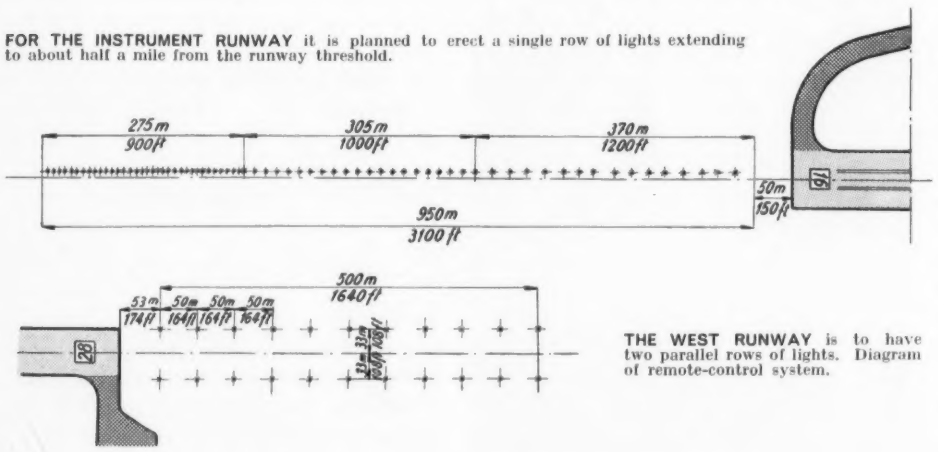
At the end of the instrument runway and of the west-east runway (10/28) is a green arrow, formed of neon elements, to signal a clear landing, and a similarly composed red cross indicating that a landing should not be made.

It must be possible to control all lighting and optical signalling equipment from a central station, which is the control tower. In view of the extremely long distances, however, it would have been far too expensive to have laid down a network of cables. For this reason the firm of Landis & Gyr, of Zug, has developed for Zurich airport a remote-control system, which, working on audio-frequencies, utilises the existing power lines for transmitting orders. The audio-frequency energy is supplied by a converter group, comprised of an asynchronous generator and an induction motor, which is switched on via a coupling transformer in the neutral circuit. The entire system, which works with a signal frequency of 300-1,000 c/s, mainly consists of a transmitter and a requisite number of receivers. Transmitter and receivers are provided with synchronised selectors: according to the orders which are given out from the control desk, selector contacts on the transmitter can be put under tension. When the release button is actuated, the selector fingers of the transmitter and of all receivers are simultaneously put into operation: if a selector contact of the transmitter closes the circuit, then a pulse enters the network and actuates a relay mechanism in the corresponding receiver. This system of remote control, working on audio-frequencies, possesses unlimited possibilities of development; and by using pulse combinations, it can be made to transmit a wide variety of orders.

Similar considerations led to the development of a remote-control system for marking obstructions around the airport. ICAO regulations demand that objects constituting a hazard to safe operations and extending beyond a defined horizontal plane in the area of the approach and departure funnels, should be made recognisable by intermittently-flashing red lights. At Zurich airport, this applies to the funnels of the west runway (10/28). At the west end, at about 1.2 miles from the runway, a group of four such lights has to be erected, and towards the east end, three further lights are to be set up at about 2.1 miles distance. Moreover, the hilly area in the south-east of the airport, between the funnels of the instrument and the west runways, is to be marked out by a further group of warning lights. Since these groups of lights are some distance from the airport, it is best that they be fed from the nearest localities, so that a remote-control system working on the afore-mentioned principle was not possible. It is therefore planned to utilise a VHF radio remote-control system for this purpose. The controlling transmitter, requiring about 50 watts, will be in the airport building and serviced from the control tower; each lighting unit will have its receiver. To assure adequate efficiency of operation, the following methods have been chosen: *a)* "lights off": the carrier of the transmitter is modulated to low frequency; the signal is amplified in the receiver and led to a relay which switches off the light. *b)* "lights on": the carrier is not modulated, as no signal tension exists; the relay falls back into position and thereby switches the lights on. Thanks to the choice of the neutral circuit principle, the lighting can never be switched off owing to a breakdown in the remote-control system. The frequency-modulated, highly-selective receiver is not affected by ordinary amplitude-modulated atmospheric disturbances, and the constantly-radiated carrier additionally suppresses such disturbances automatically. Thus an undesirable switching-off as a result of outside influences would only be possible if there were a similar frequency-modulated transmitter with at least the same field strength, frequency and modulation.

What goes for all the other equipment at Zurich airport also applies to the lighting installations: consistence with international standards; operational security; unlimited possibilities of development. The last-mentioned quality applies especially well to the system of remote-control for the hazard warning lights, which can be made to work an arbitrary number of additional obstruction beacons within a radius of 20 miles.

FOR THE INSTRUMENT RUNWAY it is planned to erect a single row of lights extending to about half a mile from the runway threshold.



THE WEST RUNWAY is to have two parallel rows of lights. Diagram of remote-control system.

FLIGHT PROPULSION RESEARCH LABORATORY AT CLEVELAND, OHIO
AERIAL VIEW OF RESEARCH INSTALLATIONS, showing Cleveland Municipal Airport in the distance.

NACA

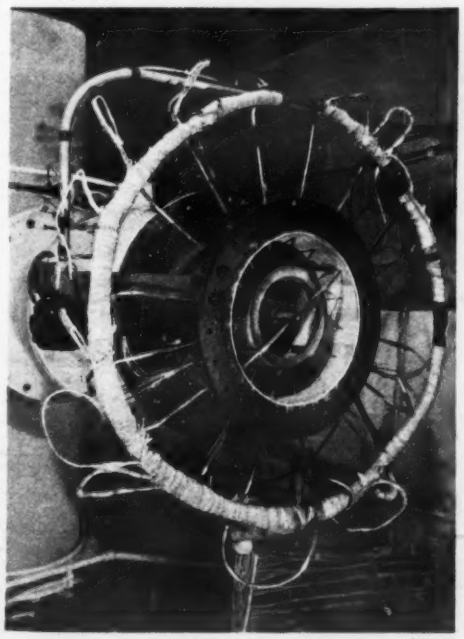
BY WILLIAM WINTER, CORNWALL BRIDGE, CONN. *

Since the creation of the National Advisory Committee for Aeronautics by the Act of March 3, 1915, which authorized the committee "to supervise and direct the scientific study of the problems of flight with a view to their practical solution," the NACA grew quietly at its Langley Field site, in Virginia, until the advent of World War II. Then the deluge of work led to the construction at Moffett Field, California, of the Ames Aeronautical Research Laboratory, specializing in high-speed large-scale research, and of the great Flight Propulsion Research Laboratory, at Cleveland, Ohio.

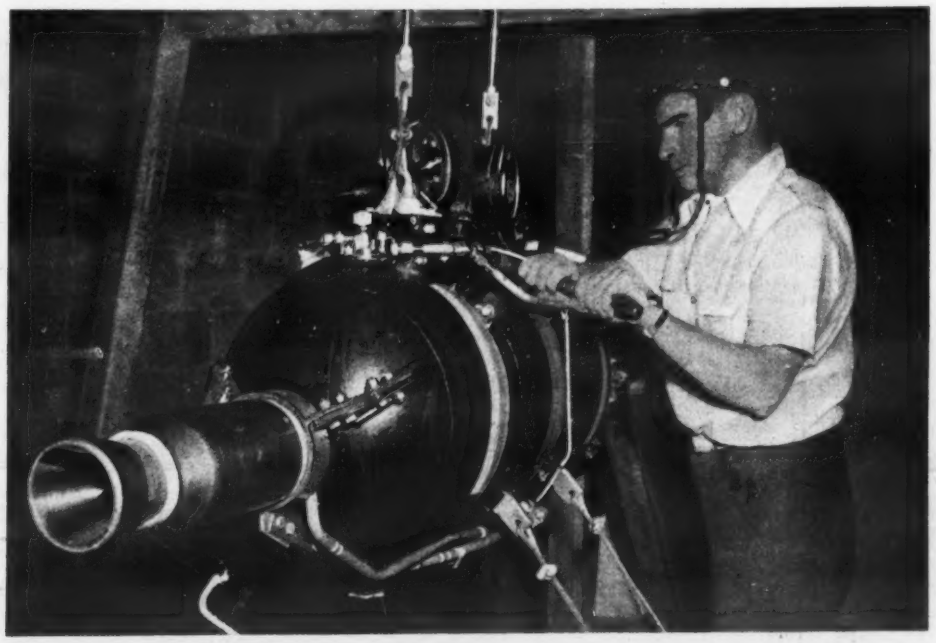
The accelerated pace of new military designs compelled the speedy development of the low-turbulence, pressurized type of wind tunnel, which duplicated quickly and accurately in model tests, flight conditions up to the highest

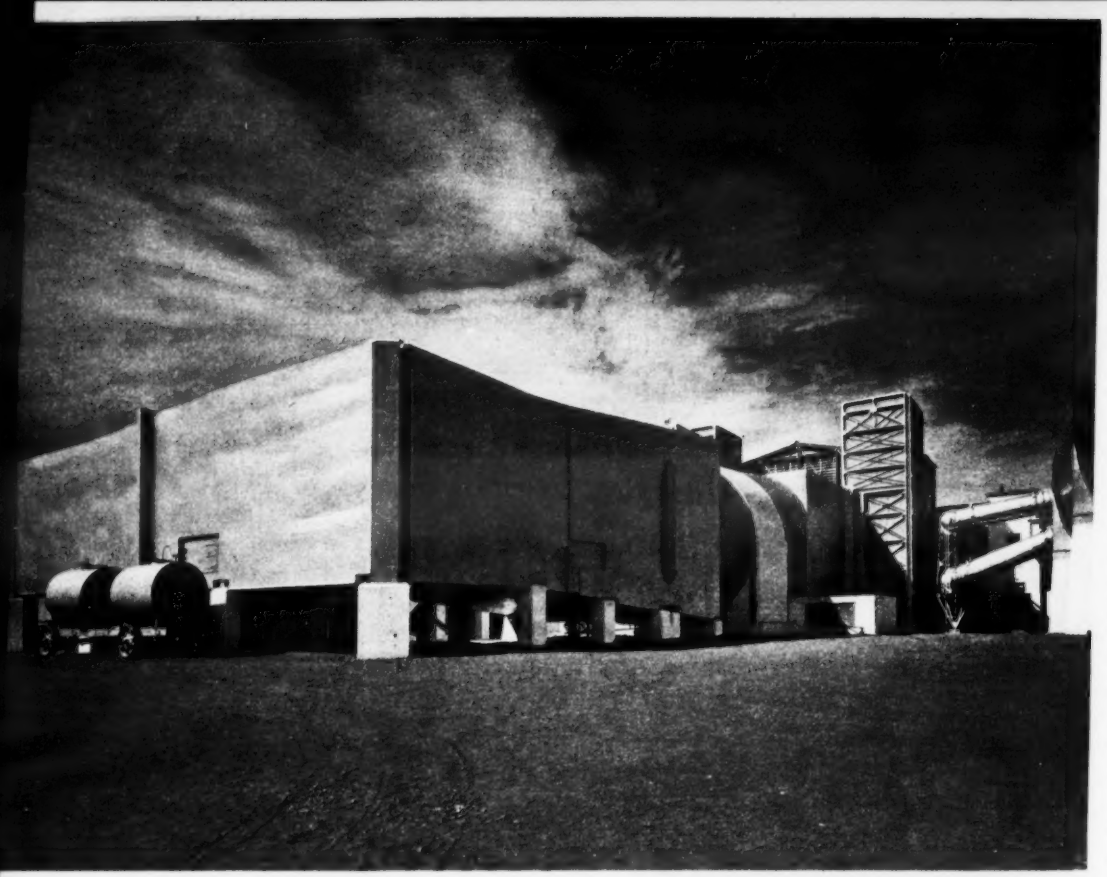
* Part 2 and conclusion. Cf. "INTERAVIA, Review of World Aviation," May, 1948.

THREE-POINT THERMOCOUPLE measures the temperature at the annular combustion chamber of a Westinghouse "Yankee" jet.



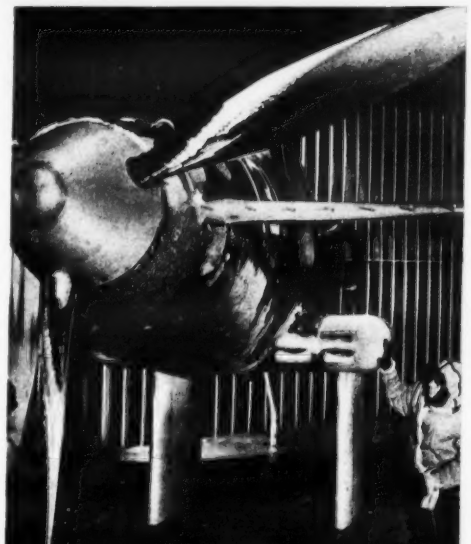
JATO TAKE-OFF ROCKET being readied for testing the combustion characteristics of its fuel.





EFFECTS OF ICE ON POWER PLANTS are investigated in this special rectangular wind tunnel.

subsonic speeds. The first of these tunnels began service at Langley in 1940. In 1947 a larger tunnel of the same type (12-foot-diameter test section) went into operation at Ames. But the greatest difficulties came when air flows approached Mach 1. Because the familiar shock waves that marched across wings also marched through wind-tunnel test sections, several unique substitute or alternate test methods were devised. By using the sky itself as a wind tunnel, researchers avoided the troublesome shock waves that rebounded from tunnel walls. Rocket-propelled missiles and free-falling bodies were used as vehicles. In combination with the development of radar-tracking and photo-theodolite-tracking techniques, these methods produced results on a par with the theoretical, tunnel, and standard flight approaches. Another technique, known as the NACA wing-flow method, involved mounting test sections in the region of high-speed flow above the wings of the fastest fighters.



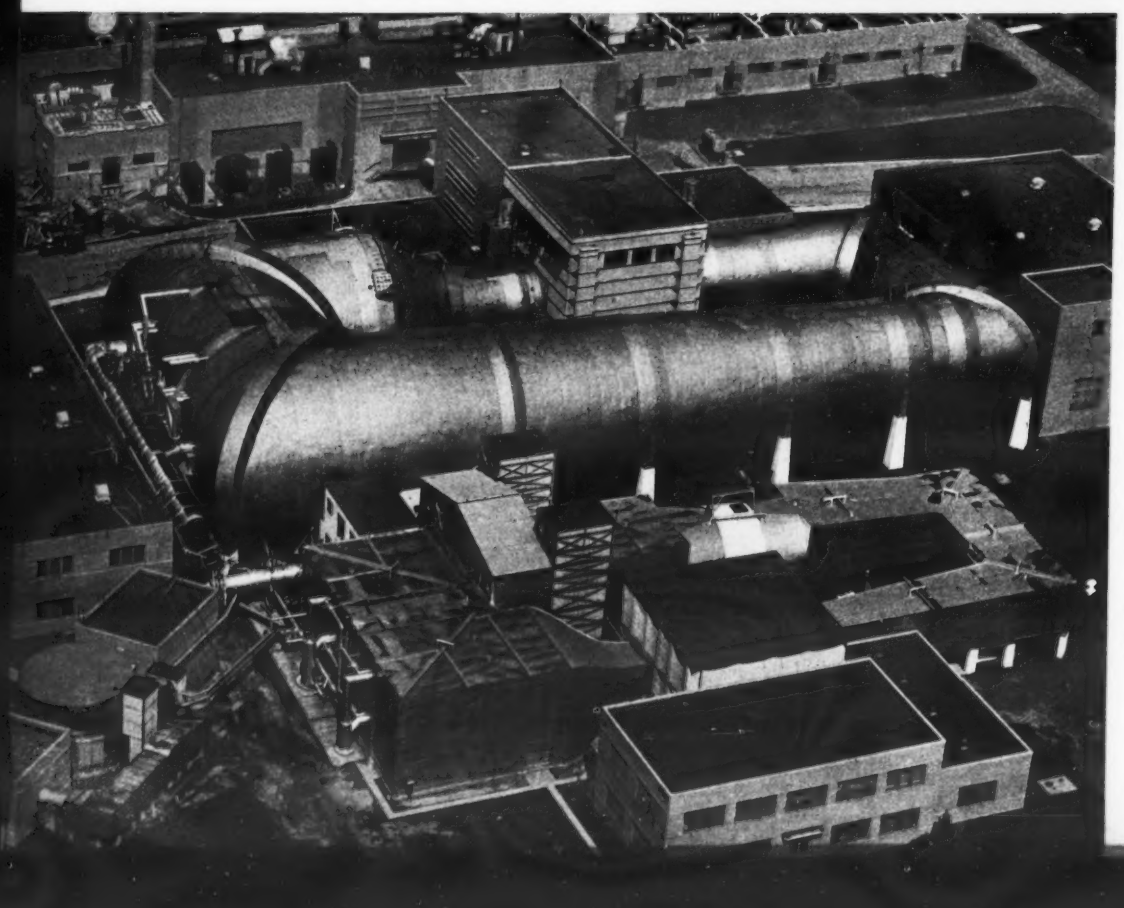
AFTER A FLIGHT IN WINTRY FOG, engine and propeller look like this equipment under test in the Icing tunnel.

Since the speed of sound occurs in Freon gas at an appreciably lower figure than in air, special tunnel tests were worked out that had the further advantage of permitting the use of the same test equipment to cover independently the ranges of Reynolds Number and Mach Number. Most of this work was conducted in the Langley supersonic sphere, where airfoils were whirled throughout the speed range, or in the Langley free-flight gallery, where models were catapulted at various velocities through a long tank of air, Freon, or air-Freon mixture.

Both above and below this troublesome region, more or less normal tunnels operate successfully. The NACA has six supersonic tunnels in operation, three at Ames, two at the Flight Propulsion Laboratory, and one at Langley.

During the War fundamental research had virtually been sidetracked by the exigencies of corrective research. Since fundamental research is more the true work of the NACA, any too-detailed picture of the vast volume of wartime corrective research would be a case of the "tail wagging the dog." The Langley full-scale tunnel and the Ames 40 × 80 foot tunnel figured in the "clean-up" of 28 different military airplanes. By tests in these tunnels, and in flight, aerodynamic design was improved to the point where it was no longer possible to realize any further important drag reductions in the airplane we know today. In general, it was found that careful detailed design was more important in aerodynamic cleanness than the original disposition of wing, tail, cockpit enclosure, power plant, accessories, and so forth.

Since 1939 NACA has tested some 60 types of airplane, from light planes to bombers, to increase fundamental knowledge of stability and to establish quantitative requirements for satisfactory flying qualities. NACA specifications were incorporated by the Services in their own specifications for new types. Any aircraft meeting these specifications is reasonably sure to fly safely and have creditable flying and handling characteristics.



WIND TUNNELS AT CLEVELAND. At the rear is the Altitude wind tunnel; the Icing Research tunnel is in the foreground. Between them, to the left, are the supersonic research installations.

FLIGHT PROPULSION RESEARCH LABORATORY.

If war had the effect of diverting the major portion of aerodynamic work into corrective channels, it had an ever greater effect on the

destinies of power plant research. Before 1940, this work was carried out on a comparatively small scale by the Power Plants Division of the Langley Memorial Aeronautical Laboratory, at the National Bureau of Standards, and by various institutions and organizations. The propulsion laboratory was still two years away. Primarily concerned with fundamental problems of increasing power, efficiency, and reducing the fuel consumption of piston engines, the Power Plants Division was, perforce, becoming interested in the specific problems of increasing power, efficiency and reliability of military engines in the development and production stages. The catch was, of course, that all this effort involved only the piston engine. With the completion of the Flight Propulsion Research Laboratory this work was stepped up, and the programme on fuels and combustion studies, begun at Langley, was continued at Cleveland on a larger scale. Throughout 1943 and 1944 research projects concerned with completed engines and components were begun as facilities became available. This intensive effort was quickly complicated by the urgent need for instituting research in jet propulsion. For example, the first studies made in the altitude wind tunnel, completed in 1944, involved the performance of a gas turbine installation in a fighter airplane. But on the whole, the engine laboratory was geared to the airplane development programme, and this governed the shift from piston to jet engine.

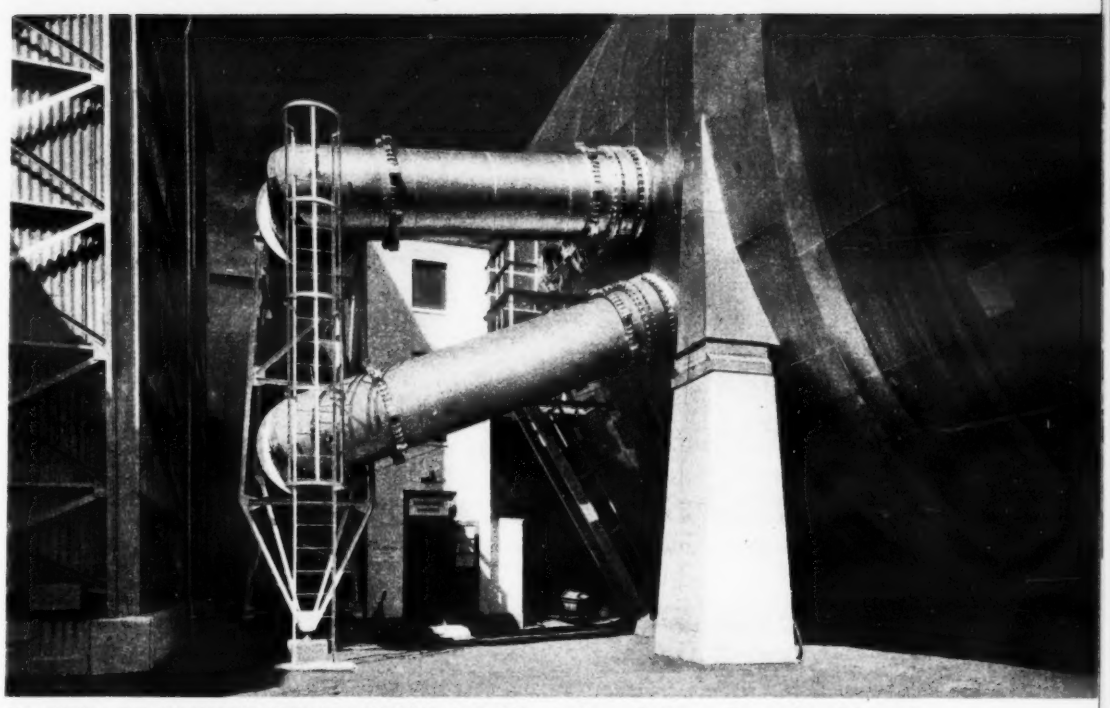
To outline the work conducted at the Cleveland laboratory is more difficult than tracing the broad outlines of aerodynamic research at Langley or Ames. This sprawling 200-acre scientific phenomenon, with its $34,000,000 worth of buildings and laboratories, is exclusively dedicated to the amassing of basic information that can be used for the development of the most powerful, safe, and dependable power plants. Its research staff is divided into four divisions which cover the entire field of aircraft propulsion. These divisions are :

1. Compressor and Turbine Research Division,
2. Engine Performance and Materials Research Division,
3. Fuels and Thermodynamic Research Division,
4. Wind Tunnel and Flight Research Division.

Whereas the spectacular, and at times freakish, wind tunnels of the Langley Laboratory are basically simple in principle and therefore easily described, the intimate, highly technical, and very specific problems solved at the Propulsion Laboratory in Cleveland seem to defy any concise generalization.

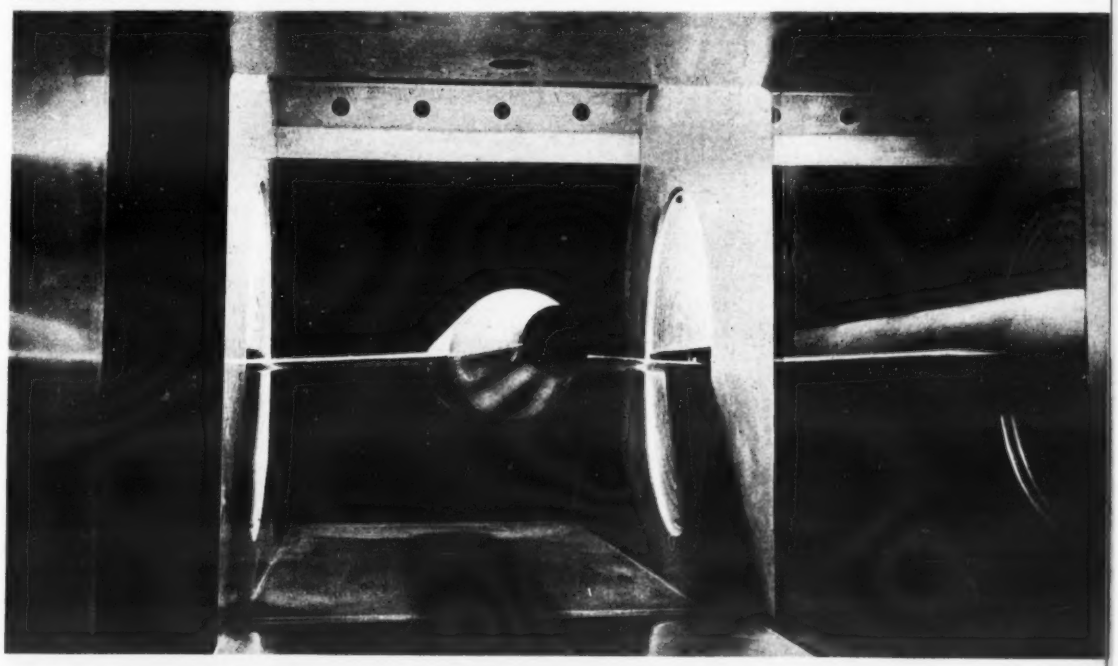
In the 5 1/2-acre Engine Research Building are found large refrigerating machines, pumps, evacuators, exhaust gas coolers, and the other paraphernalia needed to duplicate any and all flight conditions. By improving materials and operating techniques, the Engine Performance and Materials Research Division works to increase power, fuel economy, and power plant reliability, and to reduce weight. Much of this work, done on time-saving single-cylinder piston engines, and also on jet engines, is carried on in the Engine Research Building. In the Fuels and Lubricants Building, chemists of the Fuels and Thermodynamic Research Division synthesize and purify engine fuels suitable for the thermodynamic cycles of individual engine designs. Most of these fuels have only been used previously in small quantities, but are eventually tried in various power plants for ascertaining knock-limited or other performance characteristics. Rocket fuels are studied independently on dynamometer stands in the High Pressure Combustion Laboratory. Methods for increasing the thrust of jet systems are developed in the Jet Propulsion Static Test Laboratory. Only the Wind Tunnel and Flight Research Division depends on that familiar research tool, the wind tunnel.

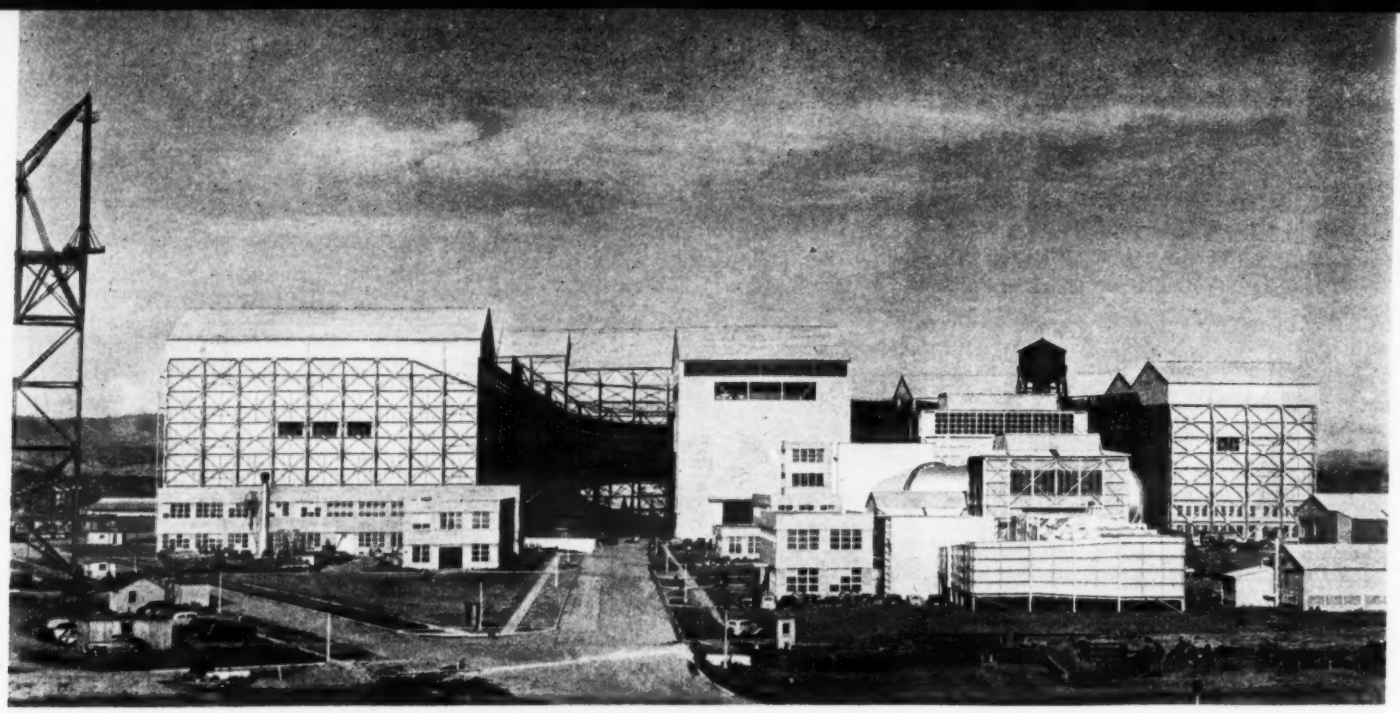
Here, the world-famed Altitude wind tunnel enables power plants to be examined under conditions simulating the atmosphere up to 50,000 feet altitude, and provides speeds up to 500 m.p.h. The Icing tunnel can reproduce the dangerous atmospheric conditions which ice up airplane and engine : at temperatures



NO ENTRY ! THE SUPERSONIC RESEARCH BUILDING is forbidden territory. Inside are the amazing wind tunnels for supersonic research, which are coupled to the exhauster pumps and air dryers of the big Altitude wind tunnel.

A MODEL OF A RAMJET, the future power plant for ultra-high speed airplanes and guided missiles, is mirrored in the smooth interior surface of the 18-inch square supersonic wind tunnel.





AMES AERONAUTICAL RESEARCH LABORATORY, AT MOFFETT FIELD, CALIF.
THIS VIEW OF AMES is dominated by the gigantic wind tunnel for research on full-scale airplanes, but the many other, smaller tunnels are of inestimable scientific value.

below freezing, more than a ton a minute of water is atomized and sprayed at up to 435 m.p.h. against the test object. Equipment also includes a brace of supersonic tunnels.

AMES AERONAUTICAL RESEARCH LABORATORY.

Activities at Ames are classified under these four heads :

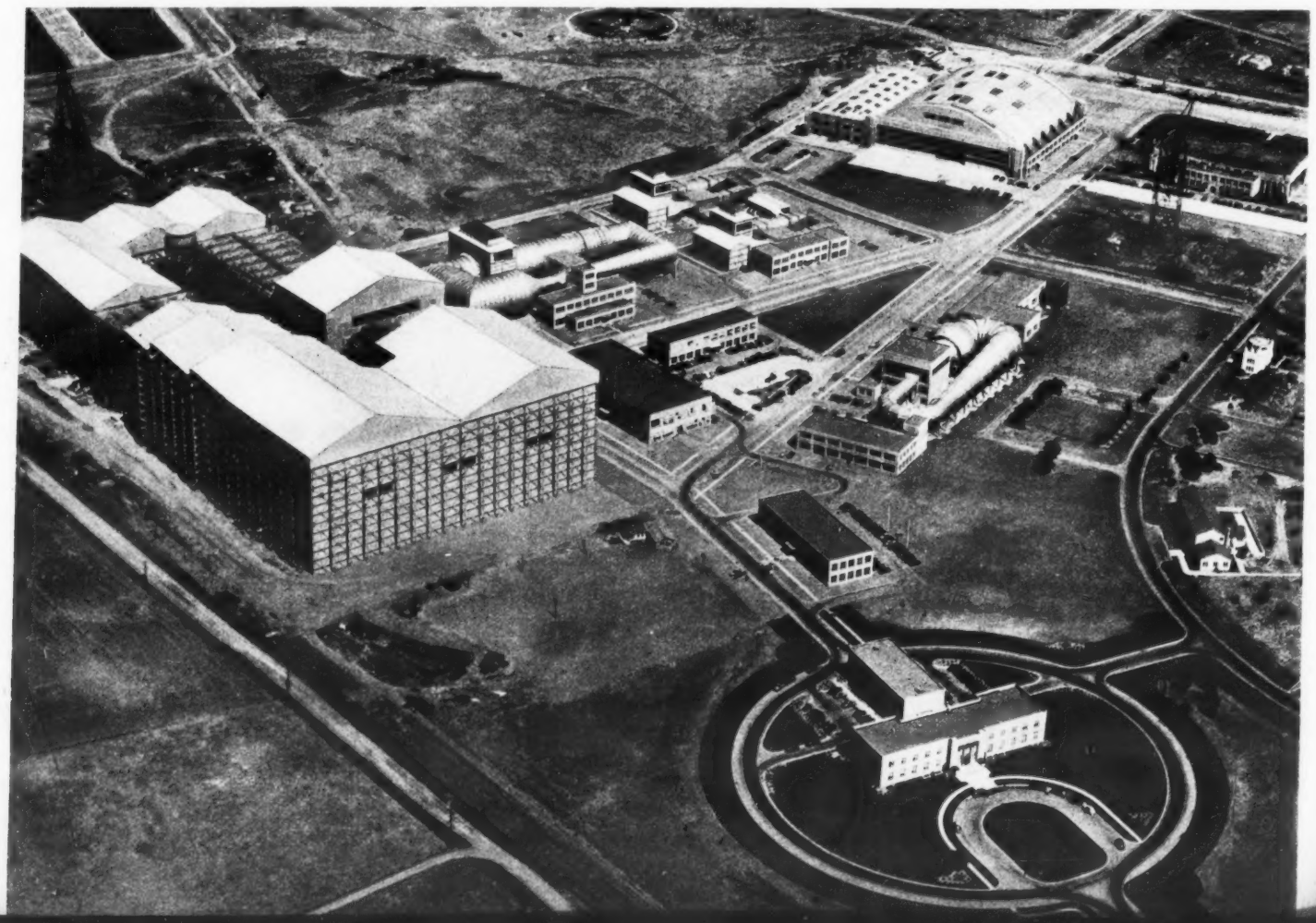
1. General Aerodynamic Research,
2. Airplane Performance,
3. Airplane Stability and Control,
4. Propulsion Aerodynamics.

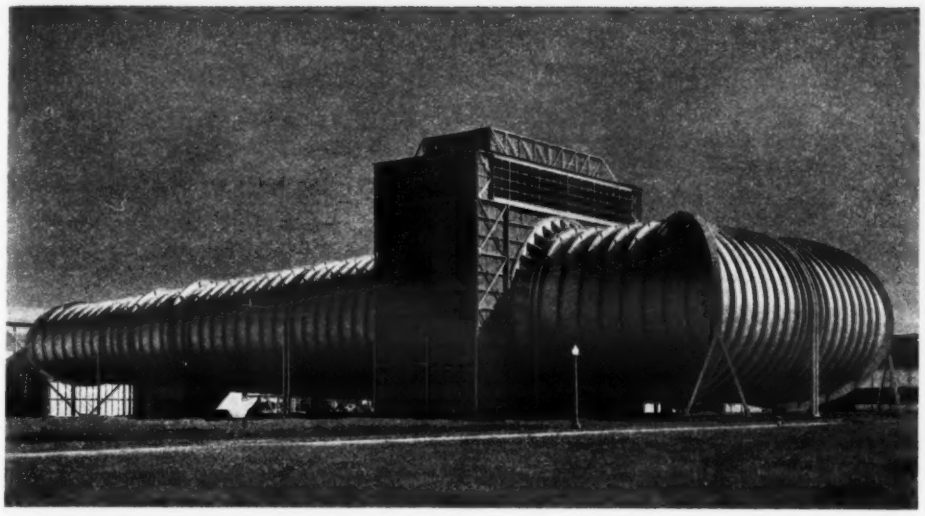
The nature of this work is understood from the description of activities at Langley. It will be noted that Ames does not conduct the diversification of investigations at Langley, but specializes in high-speed, large-scale research of the most fundamental nature. To conduct these activities, Ames is organized into three divisions :

1. Theoretical and Applied Research Division,
2. High-Speed Research Division,
3. Full-Scale and Flight Research Division.

As would be expected from its mission of high-speed and large-scale research, Ames has a formidable collection of highly specialized tunnels for this work. In addition to twin 7 × 10 foot closed-throat tunnels for low-speed stability and control development at velocities up to 300 m.p.h., and a 16-foot subsonic tunnel capable of velocities up to Mach 9, the Theoretical and Applied Research Division has, in its 12-foot, low-turbulence pressure tunnel, what is said to be the only tunnel in the world capable of handling three-dimensional bodies at both very high Reynolds Numbers and very high speeds. It is capable of reducing turbulence to a negligible value and of producing pressures from 1/6 to 6 atmospheres, and velocities up to the speed of sound. The significance of this fine research tool can be realized from the fact that at a pressure of six atmospheres a ten-foot model is the equivalent of a 60-foot model at standard sea-level pressure.

AIR PHOTO OF AMES showing, left to right, the big wind tunnel, the 16-foot tunnel, the two 7 × 10 ft. tunnels and, further towards the front, the 12-foot pressure tunnel.





THEORETICAL AND APPLIED RESEARCH

THE 16-FOOT SUBSONIC TUNNEL supplies speeds up to Mach. 9, thus 90 per cent. the speed of sound.

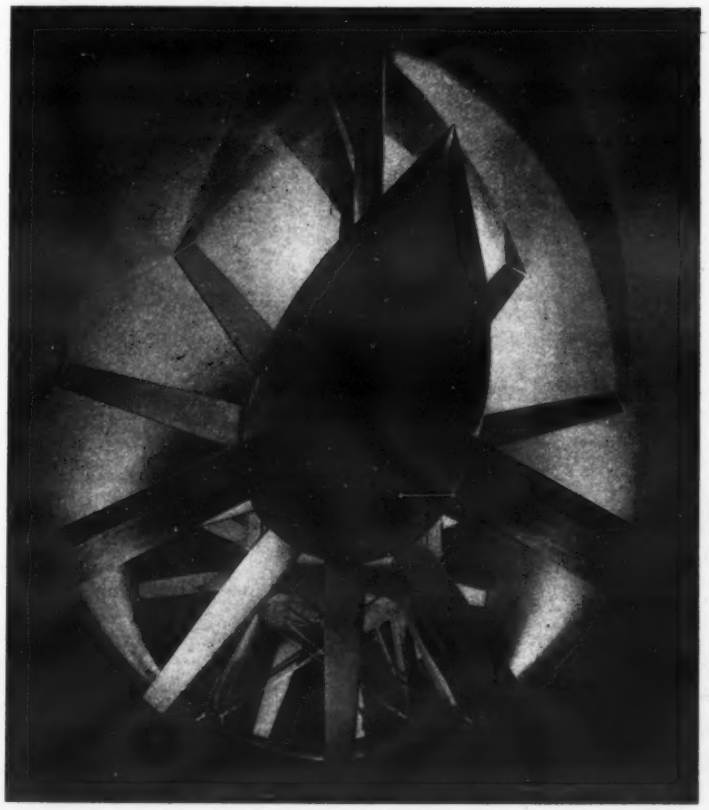
P-51 MUSTANG MODEL mounted in the 16-foot tunnel at Ames.

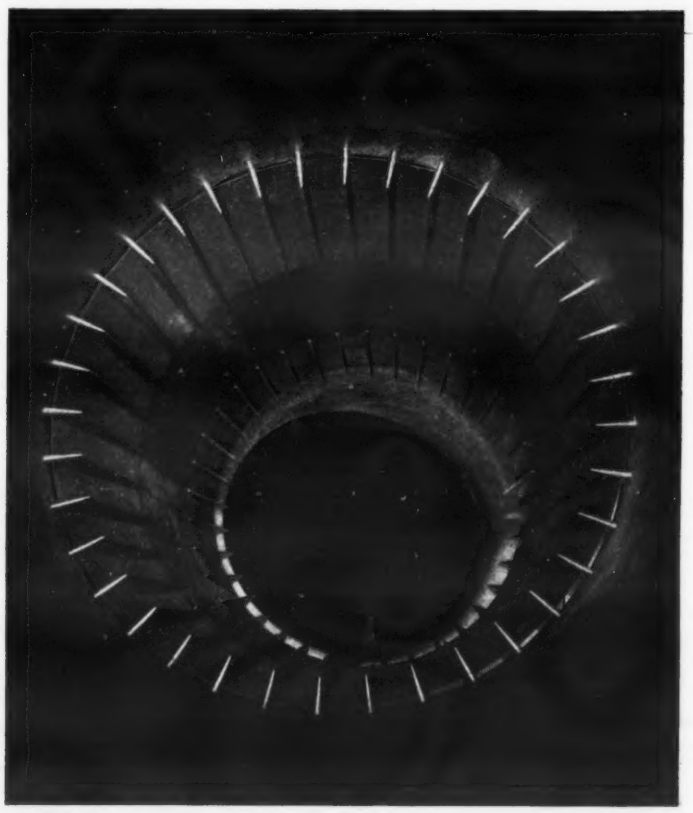
Although the tunnels used by the Ames High-Speed Research Division would be the *pièce de résistance* for the engineer reader, the layman would undoubtedly find them anti-climatic. Compared with the 40 × 80 foot goliath used by Full-Scale and Flight Research, these ultra-high speed tunnels do seem mere toys. Yet, as small as they appear to the uninitiated, they are literally worth their weight in gold. One is the 1 × $3^1/_2$ foot unit which operates up to the speed of sound. Then there is a pair of 1 × 3 foot supersonic tunnels. One requires four blowers and 10,000 H.P. to attain Mach Numbers of 1 to 2.2, and the other manages velocities up to Mach 3.4, or 2,500 m.p.h., by bleeding compressed air from the 12-foot pressure tunnel. Pressure and humidity are controlled to offset the small (8-inch) spans of the test models. Finally there is the 8 × 8 inch tunnel (using compressors of the 12-foot tunnel) to investigate duct entries and exits at speeds up to Mach 2.3.

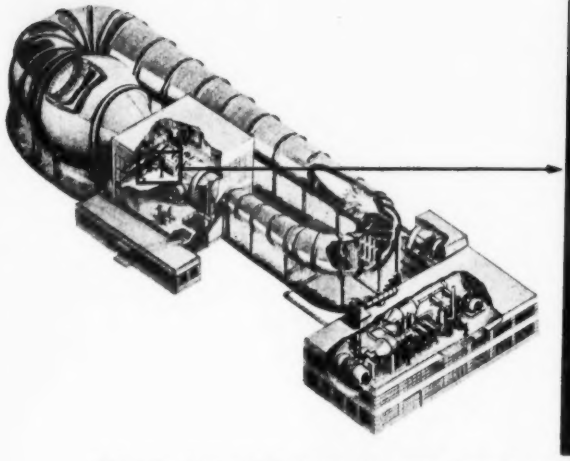
But probably the best-known of American tunnels, thanks to its impressive pictures, is the full-scale 40 × 80 foot tunnel. Its fame stems from the fact that it covers eight acres, and that the maximum size of the air passage is 172 × 132 feet. Airplanes up to 70-feet span can be tested at speeds as high as 250 m.p.h. During the War this tunnel was useful in analyzing test airplanes that had developed unforeseen difficulties.

A year ago, the 32nd Annual Report, which reviewed the six war years for which annual reports had been omitted, had a subjective tinge. The era of the Wrights had come to a close, its end hastened by the revolutionary jets and the first encounters with the dawning supersonic air age. Although the NACA laboratories in numerous instances had been hard at work on such problems for several years, the first Annual Report in six years had to get across to the Congress that the old aeronautical order of things was gone and that, where power and speed were concerned, great advances had to be achieved in a minimum of time. The recently-released 33rd Annual Report, on the other hand, refers

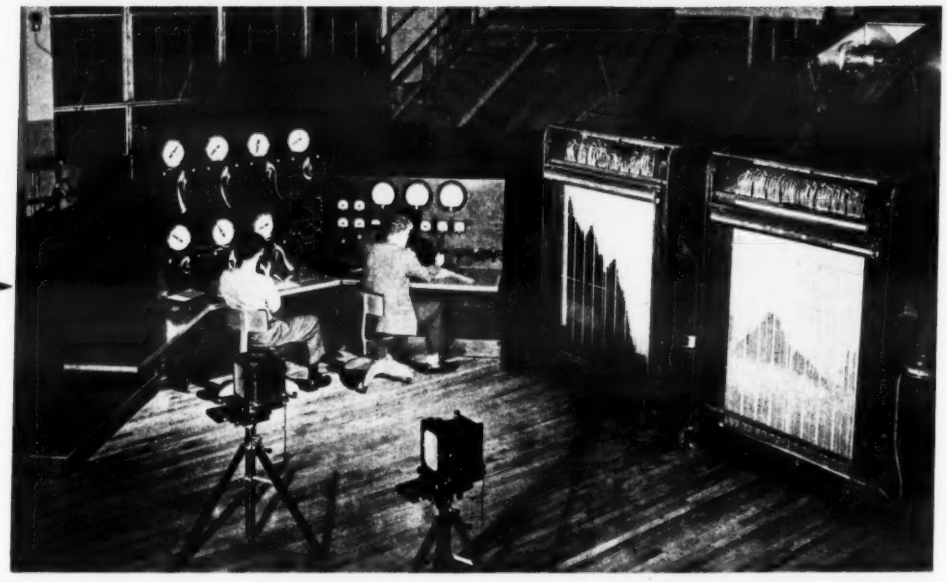
INSIDE THE 16-FOOT TUNNEL: left, cooler propeller blades; right, the wide section near to the cooling tower, showing the guide vane grids. The man in each picture—if you can find him—gives an idea of the size of the apparatus.







THE LOW TURBULENCE PRESSURE TUNNEL, measuring 12 feet across, enables results to be obtained with a 10-foot model which are valid, without correction, for a 60-foot model. It works at pressures from 0.17 to 6 atmospheres, and can produce velocities up to the speed of sound.

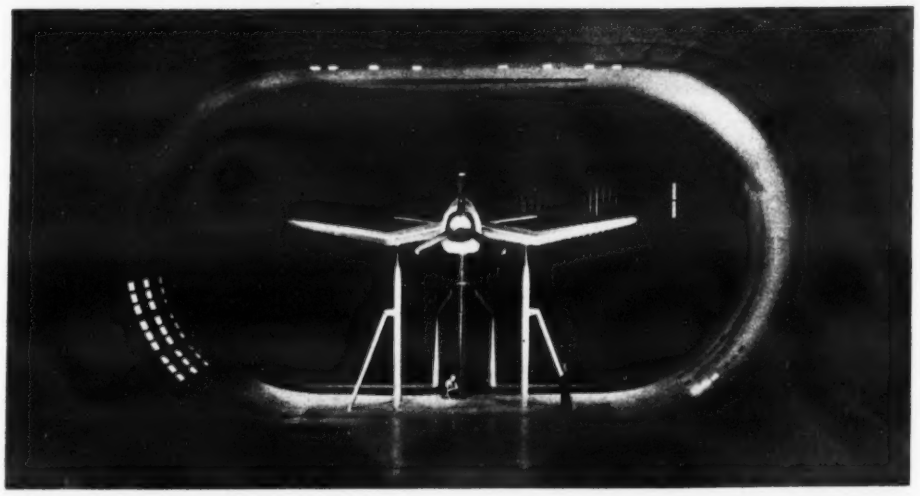


CONTROL DESK BALANCE PRINTERS AND MANOMETERS in the closed-in working section of the pressure tunnel. Air forces are automatically recorded by the balance printers, whilst pressures from innumerable points are transmitted to the water-column manometers (grouped in two cases) and recorded photographically.

not to what has gone but entirely to what must be done.

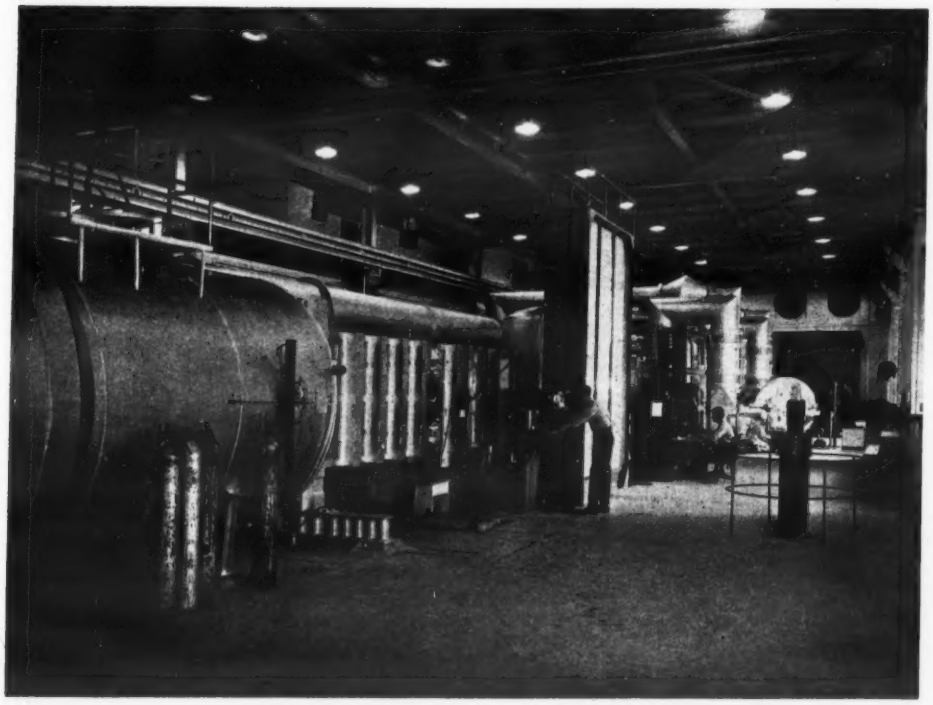
The high and increasing cost of these expanding fields of aeronautical research is evident from the appropriations for the NACA of $30,713,000 for the fiscal year 1947, and $43,449,000 for the fiscal year 1948.

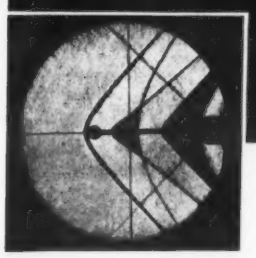
"The urgency of the aeronautical research programme," wrote Chairman Jerome C. Hunsaker, "stems from its relation to the national defence. The most powerful military weapon of today, the atomic bomb, is largely dependent for its effectiveness upon aircraft capable of delivering the bomb to its target in the face of intelligent opposition."

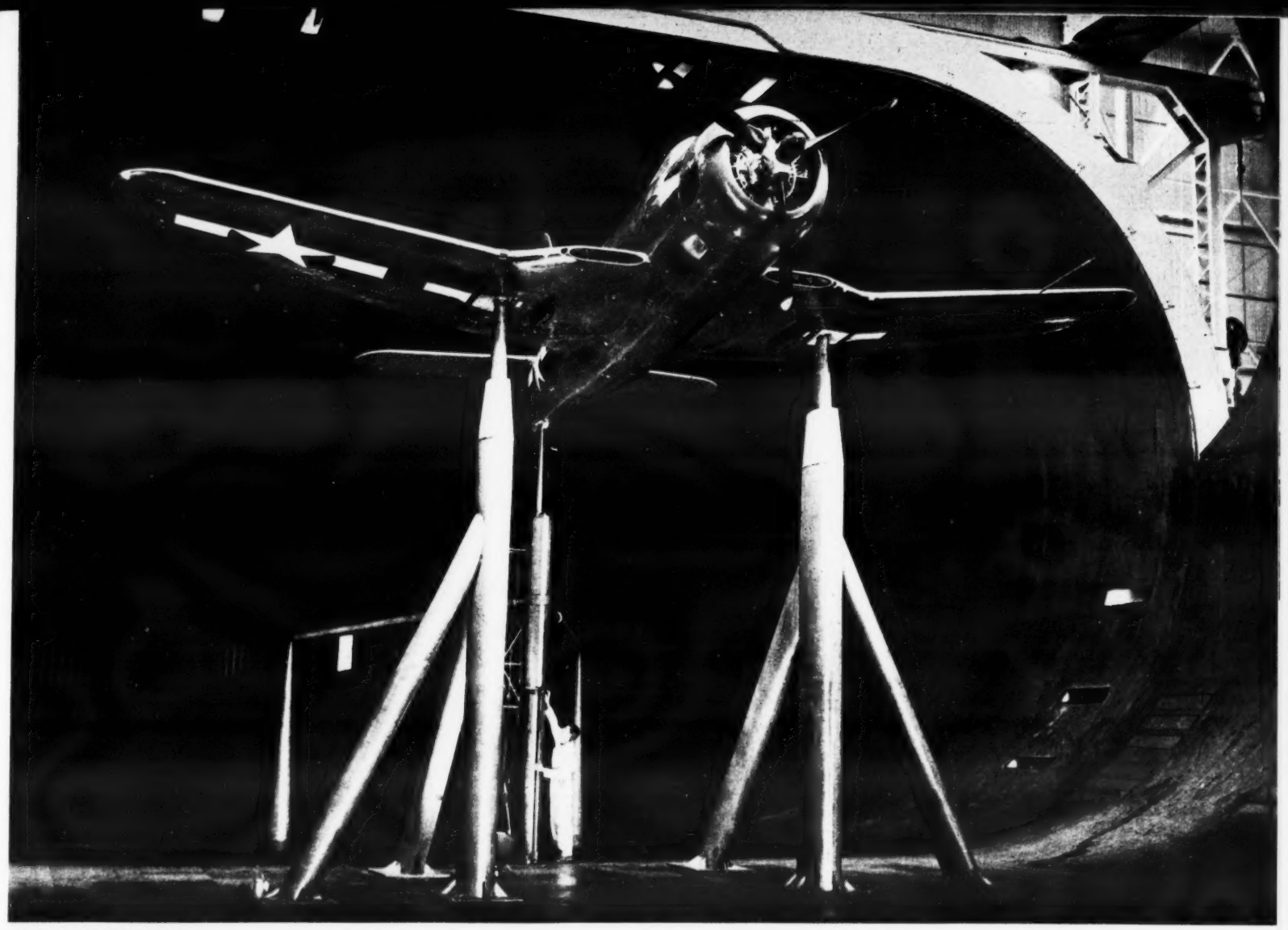


SUPERSONIC RESEARCH

ONE OF THE TWO 1 × 3 FOOT SUPERSONIC WIND TUNNELS, for speeds up to 1,600 and 2,500 m.p.h., showing on the right Schlieren equipment for photographing shock waves (small photo below).







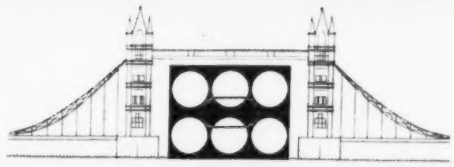
FULL-SCALE RESEARCH

RYAN FIREBALL DECK FIGHTER, which has a piston engine and a jet unit, is mounted in the big tunnel on movable supports, which transmit the air forces to balance printers.

A FIGHTER AIRPLANE IN THE TEST SECTION, with room to spare. It can be tested with engine running.

THE 40 × 80 FOOT TUNNEL, for research on large airplanes, has six blowers driven by 36,000 H.P., which produce speeds up to 250 m.p.h.

MAXIMUM SECTION OF THE GOLIATH TUNNEL, considerably more than that of the working section, is nearly the size of the passage-way through London's Tower Bridge.



De Havilland "Vampire"

By William Green, Stafford, England.

DEVELOPMENT AND GENEOLOGY

When, in 1941, the de Havilland organisation contemplated entering the field of jet propulsion, the conclusion was reached that a jet unit would require a thrust rating of about 3,000 lbs. at sea level to provide a performance sufficiently in advance of the then current "Spitfire" and "Typhoon" fighters to justify the development of a radically new fighter design at that phase of the war.

At that time, Britain was barely past her period of gravest danger and the Ministry of Aircraft Production suggested that the jet fighter ought not to be allowed to interfere with work on orthodox aircraft and might well be dropped for the time being. In May, 1942, however, the company was given permission to proceed with work on the jet fighter, but with the proviso that it should not be allowed to interfere with "Mosquito" production and the development of the twin-"Merlin" D.H. 103 "Hornet."

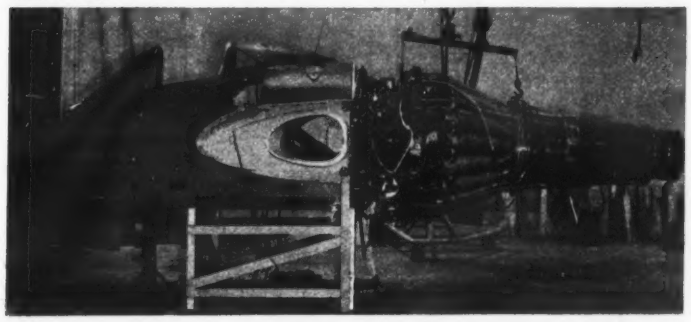
The minimum size of a pressurised cockpit for the pilot and equipment gave a permissible engine diameter of some 50 inches, and it was with this in mind that Major Frank Halford and his design team had begun work on the H. 1 jet engine, later to be known as the "Goblin." It was realised that the air intakes would provide a serious problem and that every additional foot of exhaust system would incur a loss in thrust and increased drag. It was therefore decided to adopt a twin-boom layout which, in addition to reducing the length of the jet pipe, enabled the control surfaces to be raised clear of jet interference and provided exceptional engine accessibility. The use of high-velocity ducts positioned in the wing roots served to reduce the size of the intakes and their interference with the rest of the aircraft, and yet provided maximum intake ram. The jet unit could be overhung from a strong bulkhead aft of the main fuel tank, and the tailpipe reduced in length to a minimum consistent with cleanliness of fuselage line and exhaust cone assembly requirements.

Thus was born the project known as the D.H. 100 and later as the "Vampire." Engine design proceeded alongside airframe planning, and by September, 1942, the mock-up of the new fighter was well advanced. The "Vampire" prototype, LZ 548/G, flew for the first time on September, 1943, piloted by the late Geoffrey de Havilland, thus sixteen months after the first lines had been traced on the drawing board. Its develoment had been nicely timed to fit in with that of its "Goblin" engine and the "Vampire-Goblin" combination exceeded 500 m.p.h. in the Spring of 1944, being the first aircraft in Britain or the U.S.A. to do so.

As at that time the de Havilland factories were fully occupied with the production of other aircraft, the English Electric Co., Ltd., took up the production of the "Vampire" at their Preston works and the first production model was delivered early in 1945. Since the debut of the first prototype an impressive number of "Vampire" variants have appeared, suggesting that this rugged fighter is following closely to the immortal "Hurricane-Spitfire" tradition. The latest "Vampires" have changed considerably, both internally and externally, showing that the design has in no way been frozen and a considerable amount of development work is being conducted at Hatfield on existing and entirely new variants.

The present version of the "Vampire" in general service with the R.A.F. at the time of writing, is the F.Mk.1, which has itself undergone a considerable amount of refinement since the delivery of the first Mk.1's in 1945.

Installation of the standard power plant, D.H. "Goblin II," in a "Vampire I" (3,000 lbs. static thrust).



An experimental version fitted with D.H. "Ghost" and extended fuselage rear (5,000 lbs. static thrust).

The early "Vampires" differed considerably from later aircraft, the first 40 being powered by the "Goblin I" engine whereas later Mk.1's had the "Goblin II." Another important modification on all aircraft after the first 50 Mk.1's was the adoption of a pressurised cockpit. In addition to the various interior changes, the most noticeable external differences between first and the later Mk.1's are the adoption of a "teardrop" or "bubble" type cockpit canopy and the use of 100 Imp. Gall. "airship" long-range wing tanks in place of the slipper drop-tanks which were found to be responsible for some flight fluctuation and vibration. Also, the aerodynamic effect of the drop-tanks on longitudinal stability necessitated increases in chord and area of the horizontal tail surfaces.

The "Vampire Mk. II" is an experimental version for testing the Rolls-Royce "Nene" engine. The "Vampire" was not designed for a turbine with a double-sided impeller, so that the full 5,000-lb. thrust of the "Nene" cannot be exerted. Nevertheless, there is still considerably more thrust than with the "Goblin" engine, and the "Nene"-powered "Vampire" has shown considerable improvement in take-off, rate of climb and ceiling, although characteristics are not so good and engine maintenance is complicated. External "elephant-ear" type airscoops were fitted to the top of the cowling of the "Vampire II" to feed air to the rear face of the impeller (for which purpose the cowling itself was redesigned to provide a satisfactory plenum chamber), but were discarded as they marred the "Vampire's" lines.

Further experimental models are powered by the 5,000-lb. thrust "Ghost" turbine. One of these "Vampires," on March 23rd, 1948, gained the International Altitude Record for Great Britain by climbing to 59,492 feet. The aircraft used was basically a Mark 1 airframe but had an increased wing span and was fitted with a "Ghost" similar to those being developed for the D. H. 106 trans-Atlantic jet airliner. The engine cowling had been lengthened slightly, but the overall diameter of the nacelle was unchanged. In other respects, the aircraft was mainly the same as production models. The "Ghost" powered "Vampires," although having engines of similar output to the "Nene," obtain a higher engine intake efficiency because of the "Ghost's" single-sided impeller; and this provides a considerably higher performance.

As the "Vampire" was specifically designed for the "Goblin" it is logical that the development of this aircraft should be interlocked with that engine—in Great Britain at least—and the performance of production "Vampires" will not increase beyond the power limits of the "Goblin." Thus the current version of the "Vampire" being delivered to the R. A. F., the F. Mk. III, is powered by a "Goblin II." Versions with later "Goblins" (III & IV) of higher thrust will soon be in production.

The F. Mk. III is actually a long-range version of the Mk. I, but differs in a number of respects, most noticeable external changes being the new low-set tailplane and re-designed fins and rudders. The tailplane now terminates in large "torpedo" type fillets, and the fins and rudders are elliptical in form and of characteristic de Havilland outline. The tailplane has been lowered for structural reasons and it has been found that the new position does not affect compressibility characteristics, as was originally supposed.

The designation "Vampire Mk. IV" has been allotted to a hypothetical version prepared in case the R. A. F. orders the "Vampire" powered by a "Nene," which would be basically a Mk. III airframe strengthened to "Sea Vampire Mk. XX" standards and having clipped wing tips. The latest production "Vampire," the Mk. V, is to become a standard ground-attack (fighter-bomber) aircraft of the R. A. F. Essentially similar to the Mk. III, it has been strengthened structurally and embodies numerous minor changes, such as clipped wing tips, etc.; power plant consists of a "Goblin."

The "Vampire" is being exported in large quantities to a number of air forces. The Swiss government, after conducting exhaustive service tests with a trial flight of Mk. 1 "Vampires" which were supplied in the Summer of 1946, has recently placed a contract for 75 aircraft. This version is basically similar to the R. A. F.'s Mk. V, and, developed especially for operations in Switzerland, is known as the Mk. VI. One major change is that the "Vampire" Mk. VI will embody a higher-powered "Goblin" than its R. A. F. counterpart—probably a "Goblin III" or IV, which each give a few hundred pounds more thrust. The Mk. VI will have provision for four 60-lb. rocket projectiles under each wing, which will enable the aircraft to undertake an army-support rôle. Additionally, the Swiss "Vampire" will be capable of carrying one 500-lb. bomb or one 100-gallon drop tank under each wing. The standard armament of four 20-mm. cannon is retained. The versatile characteristics of the "Vampire" suit it to Switzerland's unusual operational and tactical conditions and it has been found easy to operate from the small airfields in Switzerland's mountainous terrain.

The Swedish Air Force has taken delivery of a number of Mk. 1 "Vampires" and has placed an order for a large quantity of units of a version to be known as the Mk. 50, which will probably have a Swedish-built "Goblin." The Norwegian government has recently ordered four "Vampire" Mk. III's for testing, prior to the probable placing of further orders; and the Royal Canadian Air Force is to use the Vampire Mk. III as standard equipment. (The R. C. A. F. previously conducted a successful series of cold-weather tests with the "Vampire" Mk. 1.)

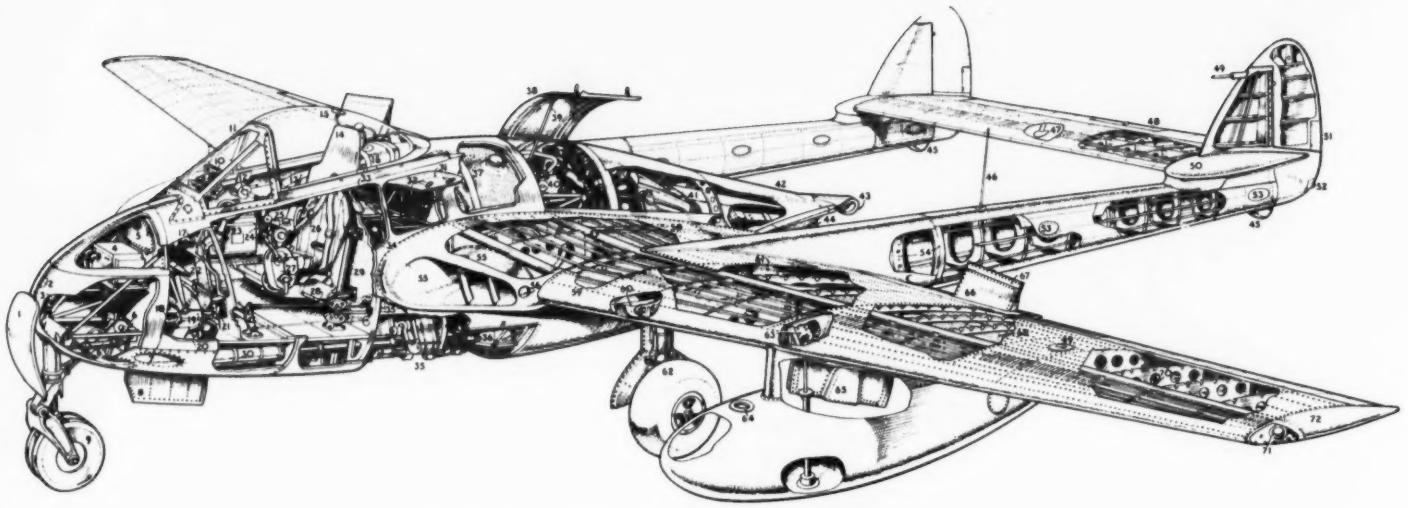
"VAMPIRE III"

The "Vampire III," powered by a "Goblin II" developing 3,000 lbs. static thrust, is armed with four 20-mm. cannon in the fuselage, two on each side of the nose-wheel. The fuselage is of oval cross-section, built in two halves and attached along the top and bottom centre lines. It is of carapace construction with two plywood skins separated by balsa wood. The pilot's cockpit is divided from the light-alloy nose-section by a heavy armour-plate bulkhead. The nose section can accommodate special radio equipment, a glycol reservoir, and a cine-camera connected electrically with the cannon. To the rear of the pilot's cockpit the fuselage is faired into the cone-shaped metal cowling enclosing the "Goblin II," which, located aft of the fireproof bulkhead, picks up at four points of a steel-tube engine mounting. The pilot's cockpit is enclosed by a standard "bubble" or "teardrop" type moulded canopy, which slides backwards, and has a laminated bullet-proof windscreen. A Marshall cabin supercharger provides pressurisation and heating.

The two-section mainplane is of metal cantilever design with an "I" section main

"Vampire II" with Rolls-Royce "Nene" turbojet and "elephant-ear" airscoop for rear compressor half. In this version the "Nene" does not exert its full thrust of 5,000 lbs.

The present standard fighter of the R.A.F. and R.C.A.F., the "Vampire III" with "Goblin II" engine, has modified vertical tail surfaces and a lower-set tailplane. The undercarriage retracts completely (cf. title picture).



CUT-AWAY DRAWING OF THE "SEA VAMPIRE MK. XX"

(By Roy Cross)

1 : Nose-wheel fairing panel ; 2 : Camera port ; 3 : De-icing spray hand-pump reservoir ; 4 : I.F.F. set ; 5 : Ground test charging point for pressure system set in armour door giving access to rear of instruments ; 6 : Nose-wheel retracting mechanism and jack ; 7 : Gun ports ; 8. Nose-wheel fairing door ; 9 : Nose-wheel with double-tread Marstrand tyre ; 10 : Gyro gunsight ; 11 : Windscreen panel ; 12 : Hood winding handle ; 13 : Air trunk from Marshall pressure-cabin blower ; 14 : Armour headplate ; 15 : Double-walled sliding hood and de-mister connection ; 16 : Hydraulic tank ; 17 : Instrument panel (cut-away to show cockpit interior) ; 18 : Adjustable rudder pedal ; 19 : Nose-wheel housing well ; 20 : Air bottle ; 21 : TR 1520 controller ; 22 : Control column ; 23 : Map case ; 24 : Hot-cold air control ; 25 : Oxygen economiser ; 26 : Pilot's adjustable seat ; 27 : Engine control box ; 28 : Long-range tanks jettison lever ; 29 : Rear armour plate ; 30 : Cannon blast tubes ; 31 : Radio access door ; 32 : TR. 1520 radio ; 33 : Z.B.X. beam-approach radio ; 34 : Oxygen bottles ; 35 : Two port 20-mm. cannon, feed mechanisms, and ammunition boxes ; 36 : Accumulators ; 37 : Fuselage fuel tank (96 Galls.) ; 38 : Port top hinged access panel to engine ; 39 : Stay rod ; 40 : Engine accessories ; 41 : Tail cone ; 42 : Built-up rear fuselage to house deck hook ; 43 : Deck hook ; 44 : Jet tail pipe ; 45 : Tail bumpers ; 46 : TR. 1520 aerial (Z.B.X. aerial is beneath starboard boom) ; 47 : Elevator mass balance ; 48 : Trim tab ; 49 : Pitot head ; 50 : Tailplane-fin fairing ; 51 : Rudder trim tab ; 52 : Navigation light ; 53 : Inspection panels in tail boom ; 54 : Tail boom to wing joint ; 55 : Port air intake to "Goblin" engine ; 56 : Pressure-cabin blower air intake ; 57 : Main spar ; 58 : Port centre section tank (53 Galls.) ; 59 : Leading-edge flexible long-range tank ; 60 : Accelerator hook ; 61 : Port wheel well ; 62 : Main wheel ; 63 : Wing jettison tank suspension point and release ; 64 : Filler cap ; 65 : Altered wheel fairing door ; 66 : Dive brake ; 67 : Dive-brake extension ; 68 : Outer wing long-range tanks ; 69 : Wing-tank filler cap ; 70 : Landing-lamp (R.I. compass on starboard side) ; 71 : Navigation lamp ; 72 : Clipped wing tip.

spar to which a false spar is attached by alclad ribs, with stringers across the span, the whole being covered by a light-alloy skin. Each wing has three attachment bolts, two at the main spar end fittings and one at a drag fitting forward of the main spar. Split flaps, dive brakes and round-nose ailerons are attached to each wing, and the wing tips are detachable. The metal tail booms each consist of two sections, the forward section being built integrally with the wing structure. The rear end of each boom is attached to a metal fin and the tailplane. The elevator extends over the width of the tailplane and, like the rudders, it is a metal structure covered by a light alloy skin.

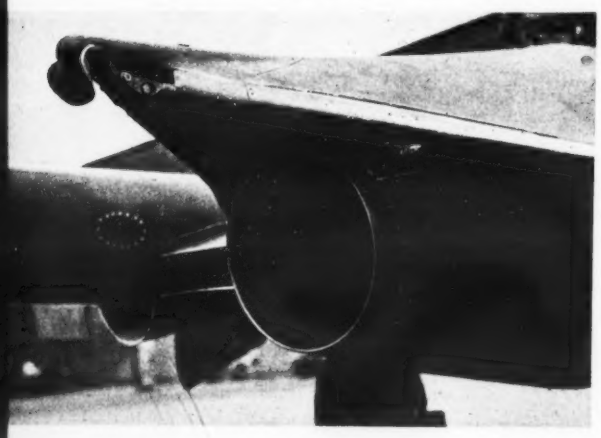
The tricycle undercarriage has two main wheels retracting outwards into each wing, and a self-centering nose-wheel which retracts backwards into the fuselage nose. The undercarriage is operated hydraulically and mechanically locked in both retracted and extended positions. The main wheels have pneumatic brakes with a differential valve operated by the rudder pedals to assist manoeuvring whilst on the ground.

The flying controls are conventional : the rudder pedals are of pendulum type with fore-and-aft adjustment utilisable in flight. The elevator has servo tabs which are also used for trimming and are operated by a hand-wheel mounted on the engine control box. The rudder trim tab is set on the ground. Control surfaces are operated via cables, the aileron control also having chain and sprockets on the control column. The lower sprocket is of oval shape in order to provide comparatively large control column movements at extreme positions to port or starboard.

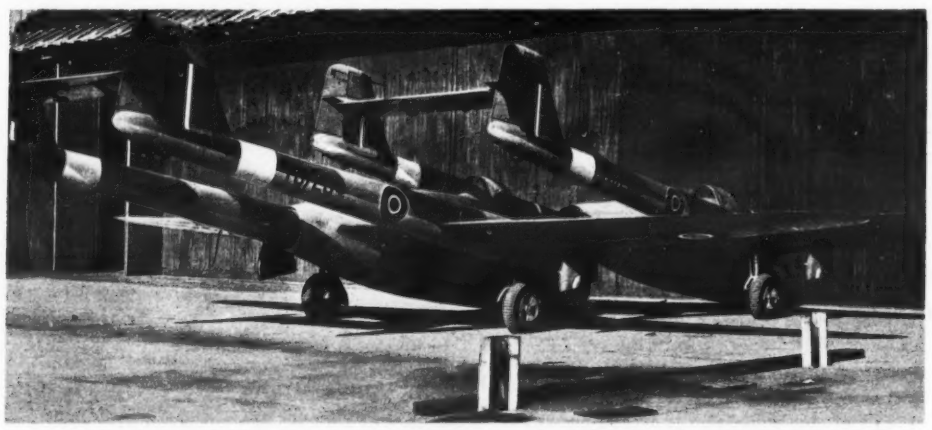
The "Goblin II" uses a single-stage compressor to supply air to its sixteen combustion chambers. A gear train driven from the compressor fan shaft drives the 1,500-watt generator, vacuum pump, fuel pump, fuel governor, hydraulic pump, Heywood air compressor and Marshall cabin supercharger. The starter motor drives this shaft and is energised by electricity from an external source.

Fuel is contained in nine main tanks, eight of which are positioned in the wing and one in the rear fuselage in front of the fireproof bulkhead. Additional 100-gallon tanks of metal, pressurised for fuel transfer by air from the pressure side of the vacuum pump, may be carried under each wing. All fuel passes through a common collector box and filter to the gear-driven pump and thence to the pressure fuel cock. Before the fuel from the pump passes to the atomisers it is subjected to three stages of control, firstly by the metering needle in the high-pressure fuel box, secondly the barostat, and finally the overspeed governor. The metering needle regulates the amount of fuel that is allowed to pass to the remainder of the power unit system and acts like the throttle of a piston engine. The barostat, a self-contained unit, is virtually a pressure relief valve, the fuel pressure being controlled by a system of aneroid capsules to deliver the correct amount of fuel to the burners in accordance with altitude and atmospheric conditions. The overspeed go-

Arrester hook of the "Sea Vampire XX," showing cowling around struts ; hinge fittings are on the wing trailing edge.



Proposal for storing "Vampires" on aircraft carriers. This picture shows the "Vampire I" without arrester hook. Note retracted nose-wheel and backwards-slid canopy.



vernor reduces the final fuel supply rate to the burners in circumstances in which the engine might be in danger of over-revving.

The entire lubricating system is housed within the power unit. A sump at the bottom of the front engine casing supplies oil for a gear-driven pump, the supply line of which is split into two streams, one for the accessory gear train and the accessories themselves, the other for the front and rear main bearings.

"Vampire III" Characteristics and Performance

Dimensions

Span	40 ft. 0 in.
Length	30 ft. 9 in.
Height	6 ft. 2 in.
Fuselage diameter	4 ft. 6 in.
Fuselage length	19 ft. 2 in.
Undercarriage track	11 ft. 3 in.
Distance between fins	9 ft. 4 in.
Wing chord :	
at tail boom	8 ft. 6 in.
at clipped tip	3 ft. 7 in.

Areas

Wing	250.7 sq. ft.
Aileron	7.7 sq. ft.
Flap	10.4 sq. ft.
Dive brake	2.96 sq. ft.
Tailplane	26.5 sq. ft.
Elevator	10.5 sq. ft.
Fin	4.66 sq. ft.
Rudder	3.31 sq. ft.

Tank capacities

Nine internal tanks	330 Imp. Galls.
Two drop tanks	200 Imp. Galls.

Weights

Structure [1]	2,630 lbs.
"Goblin II"	1,890 lbs.
Armament (+ armour)	850 lbs.
Radio equipment	100 lbs.
Fuel system	560 lbs.
Remainder	1,104 lbs.
Tare weight	7,154 lbs.
Pilot, parachute and dinghy	218 lbs.
Fuel (internal)	2,673 lbs.
Ammunition (600 rounds)	375 lbs.
Combat weight	10,400 lbs.
Two drop tanks	150 lbs.
200 Galls. drop fuel	1,620 lbs.
All-up weight	12,170 lbs.

Comparative Values

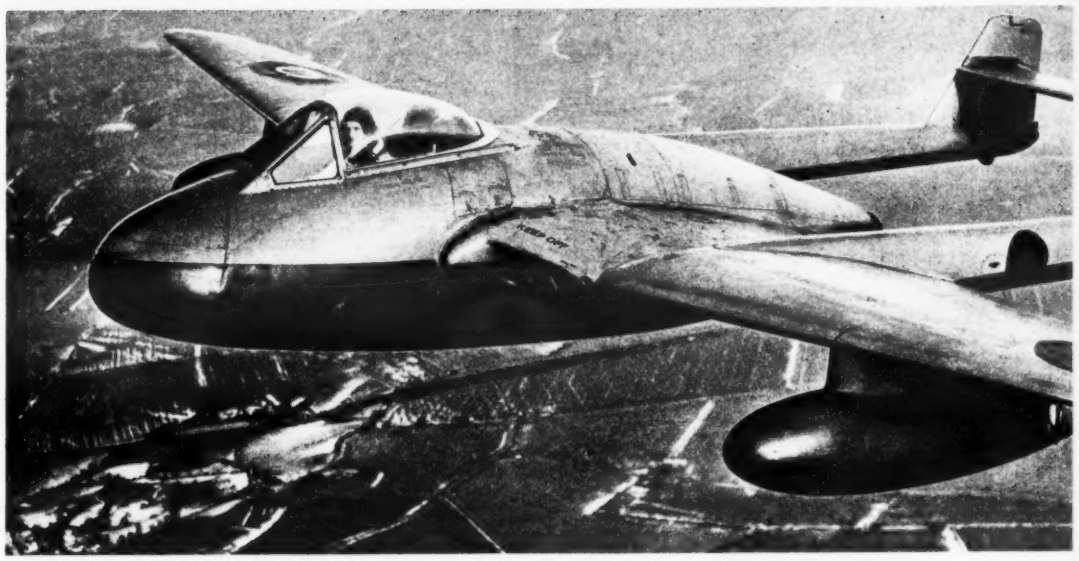
Wing loading at take-off	Max. 48.5 lb./sq. ft.
Wing loading in combat flight	Max. 41.5 lb./sq. ft.
Wing loading at landing	Approx. 34 lb./sq. ft.

Flight data

Max. speed (no drop tanks)	
at 0 — 10,000 ft.	534 m. p. h.
at 20,000 ft.	522 m. p. h.
at 40,000 ft.	485 m. p. h.
Rate of climb (9,500 lbs., no drop tanks)	
at 0 ft.	4,350 ft./min.
at 10,000 ft.	3,300 ft./min.
at 20,000 ft.	2,500 ft./min.
at 40,000 ft.	900 ft./min.
Take-off run to clear 50 ft. (at 12,170 lbs.)	1,180 yds.
Landing distance from 50 ft. (at 8,500 lbs.)	1,100 yds.
Patrol duration [2]	
at 0 ft., 220 m. p. h.	2.00 hrs.
at 30,000 ft., 350 m. p. h.	2.35 hrs.
Still air range	
0 ft., 350 m. p. h.	590 miles
30,000 ft., 350 m. p. h.	1,145 miles

[1] The structure weight is given on the de Havilland definition and excludes canopy, cockpit equipment, flying and engine controls, electric and compressed air gear, engine mounting and cowling.

[2] Patrol duration is the duration after allowance has been made for fuel used in take-off, climb and ½ hr. combat. The time for climb is not included.



'Vampire I" with newly-designed drop tanks.

NAVALISING THE "VAMPIRE"

At this stage some mention should be made of the "Vampires" at present under construction for Naval Aviation, and of the deck landing trials conducted on board the Light Fleet Carrier H. M. S. "Ocean" and its sister ship H.M.S. "Triumph." These trials gave the "Vampire" the distinction of being the first jet aircraft to land on and take off from a ship at sea.

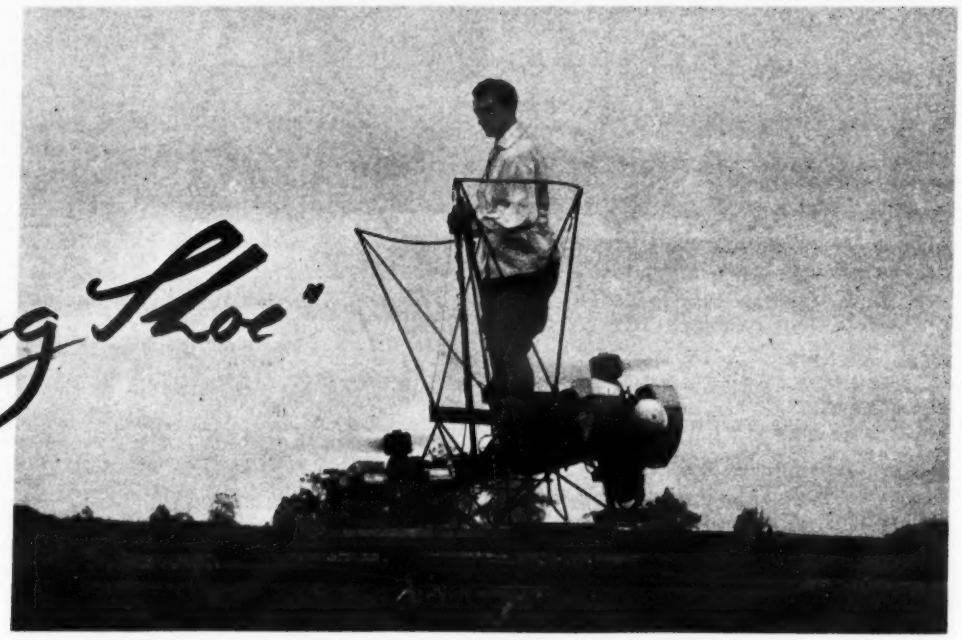
The early trials of the "Vampire" were watched by the Navy with interest. At that time very little knowledge was available regarding tricycle undercarriages on carrier-borne aircraft and even less concerning the operation of high-speed jet aircraft from the decks of carriers. Numerous problems presented themselves, the most serious of which being the relative sluggishness in response of the jet power unit when running at low output. Quick response to the throttle is often necessary in deck landing, especially in such cases as a wave-off where immediate full power is often vital, or in rough seas where the carrier may rise and fall considerably. The pilot of a jet aircraft has not the advantage of the added lift provided by the airscrew slipstream over the wing surfaces, which is invaluable for checking the sinking tendency when undershooting on the final approach. The r. p. m. variation between "throttle closed" and "full throttle" is over 7,000 r. p. m., and it is obviously impossible to accelerate the complete impeller, shafting and turbine through such a considerable range within a fraction of a second.

In order to overcome the engine acceleration problem, the design staff increased the area of the flaps by some 40 per cent.—the dive brakes were also increased in area by some 35 per cent.—to provide the means by which the drag of the aircraft could be varied rapidly, thus allowing for speed alterations to be made quickly even though the engine is running at nearly full thrust.

A lesser problem was provided by the positioning of the arrester hook. It was considered desirable to place the hook as near to the aircraft's centre of gravity as possible in order that the nose-wheel would not be pulled clear of the deck during landing. The hook frame was therefore hinged at the wing root on the end ribs of the mainplane spanning the jet pipe. This position meant that during the arresting operation, the hook and a portion of the arrester wire were placed in the jet stream. However, during the deck landing trials, it was found that this position did not provide any serious disadvantages owing to the engine being throttled back before the aircraft picked up the arrester wire. The afore-mentioned modifications were incorporated on the second "Vampire" prototype, LZ 551, and deck landing trials, which commenced on November 3rd, 1945, were completed successfully.

The six original "Sea Vampires" were actually standard R. A. F. Mk. 1 aircraft having extended flaps, increased-area dive-brakes and an arrester hook, but the "Sea Vampire Mk. XX," a small number of which are at present under construction for Naval Aviation, is a fully navalised aircraft—basically a Mk. 1 airframe with a Mk. III tail unit and clipped wings, fitted with the latest type accelerator gear and a longer-stroke undercarriage. The accelerator hooks are positioned on the wing under surfaces ahead of the tail-boom termination points, adjacent to the main spar. To guard against the possibility of nose-wheel failure, due to the latest method of flying on to the deck on all three wheels instead of the main wheels alone, the nose-wheel assembly has been strengthened and has a heavier bracing linkage. The main undercarriage has also been strengthened considerably. The latest navigational aids are fitted to the "Vampire XX" and full night-flying equipment is installed. No information is yet releasable concerning the "Sea Vampire Mk. 21."

The "Flying Shoe"



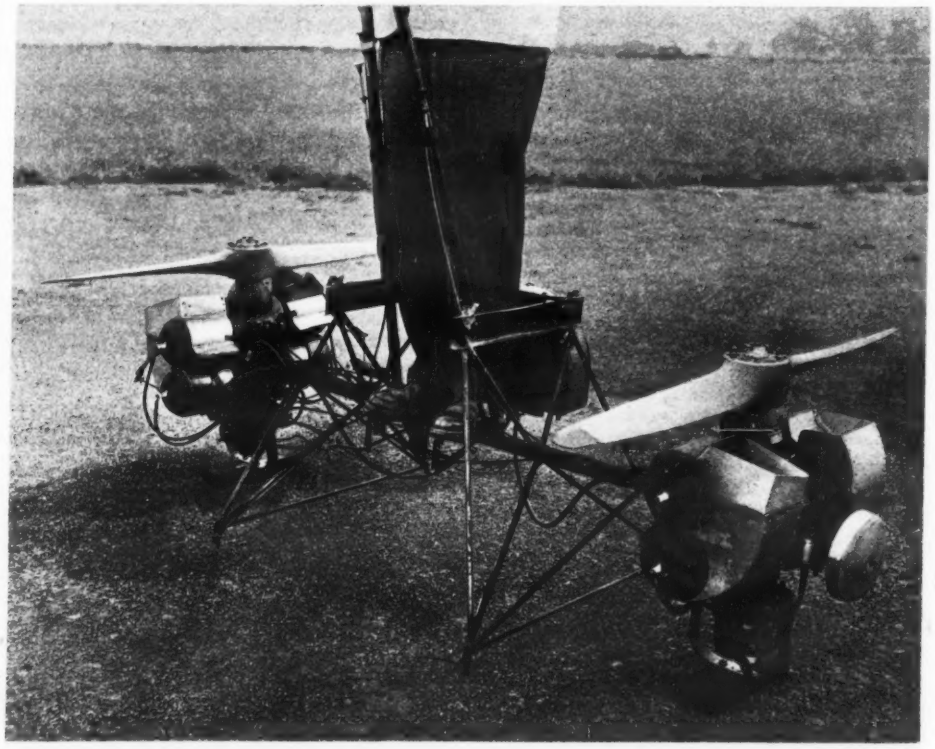
As everybody knows, the messenger of the gods, Mercury, the god of merchants and thieves, wore winged sandals. To do as much was the ambition of an American aeronautical engineer, Charles Zimmermann. And United Helicopters, Inc., the firm headed by the young helicopter designer, Stanley Hiller, Jr., fell for his invention, just as they do in principle for every inventor of a novel rotating-wing contraption.

The result is the "Flying Shoe" : At each end of a steel tube is a four-cylinder McCulloch engine with an upright shaft driving a two-blade airscrew of 30 inches diameter. This weird "pair of shoes," of which the soles are constituted by ski-type planks, carries the pilot up as he stands on the tube separating the two airscrew discs. Stirrups help to prevent the pilot from slipping sideways—an occurrence which already cost the firm's test pilot a trouserleg. Likewise in deference to the whirling airscrews, guards form a kind of pulpit around the pilot—why not, since Mercury is also the god of oratory ?

Whereas the ordinary pilot may fly by the seat of his pants, the XXth century Mercury does it by the soles of his feet—displacing his own centre of gravity. Leaning backwards produces a flare-out effect, leaning forwards... head first at full speed with two tractor airscrews !

Two "ski poles" are provided for regulating the engine. The left pole controls the output of both engines uniformly for climbing or sinking, and the right pole controls them differentially for providing lateral stability.

The best achievement of the "Flying Shoe" so far has been to rise one foot above the ground. Its worst achievement was to slice off the afore-mentioned trouserleg.



Official Bulletin of the F.A.I.

FÉDÉRATION AÉRONAUTIQUE INTERNATIONALE, PARIS

The following *international records* have been homologated by the F.A.I. :

CLASS C

Speed over 100 kilometres (Great Britain)

Squadron Leader W.A. Waterton, A.F.C.
Gloster "Meteor" Mark IV EE 528
Two Rolls-Royce "Derwent V" turbojets
Moreton Valence Aerodrome, Gloucestershire
6th February, 1948 . . . . . *873.786 km/h*

Lt.-Cdr. Michael John Lithgow
Vickers Supermarine "Attacker" T.S. 409
Rolls-Royce "Nene" turbojet of 2,270 kg. thrust
Chilbolton Aerodrome, Hampshire
27th February, 1948. . . . . *909.0909 km/h*

Squadron Leader John Douglas Derry, D.F.C.
de Havilland D.H. 108 VW 120
de Havilland "Goblin IV" turbojet
Hatfield Aerodrome, Hertfordshire
12th April, 1948 . . . . . *974.0259 km/h*

CLASS D

Category I. Single-seater sailplanes.

Distance, Returning to Point of Departure (U.S.A.)

Paul B. MacCready, Jr.
"Screamin Wiener" NX-14287 sailplane
From Wichita Falls, Texas, to Anson, Texas, and return
16th July, 1947. . . . . *368.844 km*

Altitude above Point of Departure (Sweden)

Lt. Per Axel Person
"Weihe" FV-8301 sailplane
Orebro, 12th July, 1947
(Altitude reached : 8,700 m.) . . . *8,050 m*

WOMEN'S RECORDS : CLASS C

Speed over 100 kilometres (U.S.A.)

Miss Jacqueline Cochran
North American P-51 monoplane
Packard Rolls-Royce "Merlin" engine of 1,450 H.P.
Coachella Valley, California
10th December, 1947 . . . . *755.668 km/h*

CLASS D

Category I

Altitude above Point of Departure (France)

Miss Elisabeth Boselli
"Meise" 52-9 single-seater sailplane
Saint-Auban-sur-Durance
29th December, 1947 . . . . . *3,973 m*

ROUTE RECORDS

Category I

Washington — Havana
Woodrow W. Admondson
North American P-51 monoplane
Packard Rolls-Royce "Merlin" engine of 1,450 H.P.
From Washington National Airport to Rancho Boyeros Airport, Havana
25th November, 1947
Duration : 3 hr. 37 min. 28 sec.
Distance : 1,834.386 km.
Average speed . . . . . *506.092 km/h*

Havana — Washington
Woodrow W. Edmondson
North American P-51 monoplane
Packard Rolls-Royce "Merlin" engine of 1,450 H.P.
From Rancho Boyeros Airport to Washington National Airport
27th November, 1947
Duration : 3 hr. 15 min. 13 sec.
Distance : 1,834.386 km.
Average speed . . . . . *563.800 km/h*

MODEL AEROPLANES

Elastic-band-driven landplanes

Distance (Hungary)

Model Bm-1 of Mr. Georges Benedek
From Champ de Rakos, Budapest, to the village of Hort
20th August, 1947 . . . . . *50.260 km.*

Elastic-band-driven seaplanes

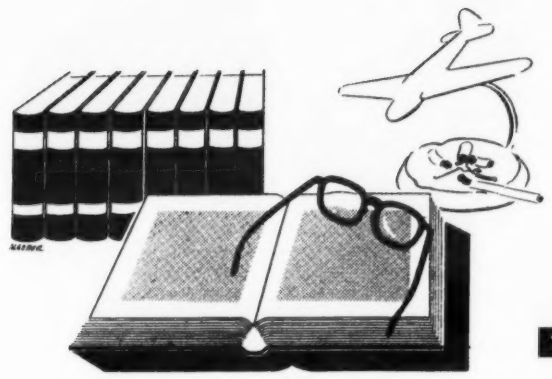
Duration (Hungary)

Model FM-7 of Mr. Antoine Fekete
From Champ de Rakos, Budapest
7th September, 1947 . . . . . *23 min. 30 sec.*

Plain Plane Sailing!

During a torrential brainstorm at H.Q., the tandem bicycle for simultaneously carrying orders and counterorders was invented. During a whimsical rainstorm another genius invented the perforated umbrella for finding out if the rain had stopped. And then we've had the spanner for left-handed people, the toothless comb for bald-headed men, and even an aeroplane that would fly backwards so as to find out where it came from.

Everybody gets his turn. The Danish caricaturist, Molvig, invented the *plane lift*. It's plain enough from the drawing that plain-minded people ought to stick to plain reading matter, and not try reading about planes. Mr. Molvig, whose inspiration for the above was an article on air pick-up carriage of mails in the U.S.A., is evidently as plane-minded as the person who, when asked what he thought of jet planes, said he preferred blondes (fancy).



Book Reviews

L'Appel des Ailes. — By André Dassart. Published by Baudinière, Paris, 1948.

The author himself says that his wish was to "deal with aviation from the standpoint of an airminded adolescent" and to speak of "the physical joy and spiritual satisfaction which one can derive from flying."

He has done this in the form of a novel, the literary value of which we shall not bother to judge. It is in reality an unhappy love story, the love being directed towards "everything with wings." Though he does not specify it, it is obvious to the reader that the book concerns the personal experiences of André Dassart.

The book is rather exaggeratedly sentimental, but it will not displease everybody : it ends well. Its greatest value lies in the descriptions of many lively episodes ; and when the author speaks of the "profession," his style becomes sober, snappier and more convincing.

Aviation enthusiasts will find excitement in the sad career of a man who, having responded to the call of the skies, is refused his wings — until the miraculous happy ending. (French.) *J.*

Kronfeld on Gliding and Soaring. — By the late Squadron Leader Robert Kronfeld. First Published by John Hamilton, London.

Scientist, engineer, test pilot, Robert Kronfeld shows above all his remarkable qualities as an instructor, for not in a single sentence of his book does he presuppose any special knowledge on the part of the reader. On the contrary, his advice to beginners is not to think too much ; flying is a matter of intuition.

The reader receives an instruction course — not in his armchair, but really in a glider, on the ground and in the air. He asks questions, and receives answers ; he makes mistakes, and gets helpful advice.

All the secrets of gliding and soaring are gradually unfolded — B certificate, performance flight, cross-country flight, cloud and storm front flying, auto- and aero-towing ; and the necessary elements of meteorology. An instructive background is provided by the experiences of Kronfeld as well as of other great soaring pilots.

Under the title "Le Vol à Voile" a French translation, published in 1947 by Gauthier-Villars, Paris, is now available on the Continent. This version is likewise well provided with photographs and sketches. *Sa.*

Molesworth's Aeronautical Engineer's Pocket-Book (2nd Edition). — Edited by Albert Peter Thurston, D. Sc., and R. H. Warring. Published by E. & F. N. Spon, Ltd., London, 1947.

The 2nd Edition of "Molesworth" needs no introduction in British aeronautical circles, as its advent has long been awaited. It represents a complete revision of the 1st edition, with the addition of as much new data as official secrecy regulations permitted at the time of publication. Thus, besides general information such as notes on Drawing Office practice, ICAN altitude tables, a full range of conversion factors, etc., the 2nd edition also contains up-to-date tables of special interest to designers, very comprehensive strength and weight data, material specifications, and details of modern constructional methods.

Dr. Thurston, who has been editing aeronautical engineers' "Bibles" since the end of World War I, has enlisted the co-operation of several official British aviation organisations, aircraft and engine firms, in assembling his data, and evidence of a practised hand is shown by the skilful way he has provided easy reference to 532 highly-informative pages by dividing them into eleven distinct sections, an appendix and an index.

Handy size and robust binding make it a real pocket-book, and the wealth of information it contains should assure its appreciation throughout the engineering professions. *Sa.*

Flight Engineering and Cruise Control. — By Harris G. Moe. Published by John Wiley & Sons, Inc., New York, 1947.

This book will find the appreciation of commercial, military and private pilots alike. Harris G. Moe, an engineer and also an experienced pilot, gives a brief and clearly understandable review of the various methods for determining altitudes and air speeds, at the same time explaining the different measuring instruments available for these purposes. He deals very thoroughly with the determination of engine output, and the relations between engine power and flight performance, whereas the two chapters devoted to supercharged engines and propellers are rather confined to the principles of the subjects, emphasising the mechanical aspects.

The author deserves full praise for his chapter on Flight Planning and Cruise Control. *Ba.*

Theoretical Aerodynamics. — By Prof. L. M. Milne-Thomson. Macmillan & Co., Ltd., London, 1948.

This book is based on Professor Milne-Thomson's lectures on aerodynamics at the Royal Naval College, Greenwich. Although it is strictly concerned with the theoretical side, it does not call for mathematical knowledge extending beyond the elements of differential and integral calculus. Thanks to the very logical structure of the book, the reader can work his way through the highly-informative subject matter without difficulty ; neither will he find an obstacle in the author's extensive use of vector methods, particularly since the last chapter is devoted to a study of the main laws of vector analysis.

Professor Milne-Thomson begins his 363 pages with a number of general problems in aerodynamics, and attaches great importance to clear and unambiguous definitions of all the expressions used. His chapters on Thin Aerofoils, Aerofoil of Finite Aspect Ratio, and Propellers, are uncommonly comprehensive and informative. Another very valuable chapter which deserves mention is that devoted to wind tunnel measurements and the corrections which must be made owing to the tunnel walls. However, the author deserves perhaps most credit for his theory of subsonic and supersonic flow, which, whilst being extremely complete, is particularly easy to consult. *Ba.*

Aircraft Structural Analysis. — Prepared by the Engineering Staff of The Glenn L. Martin Co. Edited by G. N. Mangurian and N. M. Johnston. Prentice-Hall, Inc., New York, 1947.

This welcome addition to aeronautical literature was originally compiled as the textbook for Martin Co. draftsmen and engineers, and was modelled into its present book form on the basis of classroom experience. It is concerned with the structural analysis of metal aircraft details ; apart from aluminium alloys and steel alloys (composition not stated) no other materials are specified.

The first five chapters contain a brief review of the loadings on an aircraft, continuing with an elementary explanation of the analytical and graphical methods for the resolution of forces, shears, bending and torsional moment calculations, and the analysis of joints and trusses. The next two chapters contain examples of how to calculate moments of inertia and radii of gyration on simple sections, and describe the basic concepts of stress-strain analysis.

Then comes the main part of the book (10 chapters) which, with the help of numerous examples, shows how the designer must dimension the separate sections in accordance with the data furnished by the stress analysist. Local (crippling) failures are briefly dealt with, and a step-by-step procedure for computing bending, compression and crippling stresses is thoroughly analysed in tabular form. A good number of pages are devoted to rivet and bolt joints. The practician will appreciate the appendix containing numerous informative tables on section and material properties, design, shear and tension values, weights, etc., and graphs for computing allowable column stresses, shear flows and local buckling stresses.

The book is profusely illustrated, sharply divided into sections, and provided with an index to facilitate reference. *Ri.*

THE MONTH IN REVIEW

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POLITICAL NEWS

● *An Anglo-French Military Transit Agreement* was signed in Paris on April 19th. It provides for flights by military aircraft of both signatories over each other's countries and their servicing at R.A.F. and French Air Force bases. This is of special significance for the safeguarding of Empire communications (with the Middle East for Great Britain and with Madagascar and West Africa for France). Since the War R.A.F. aircraft have had these facilities and the agreement merely formalises the arrangement. However, it paves the way for closer technical and strategical co-operation between the two Air Forces.

● *Negotiations between Sweden and India* have led to the conclusion of a bilateral air agreement. This facilitates the opening of the projected SAS service to India, to be operated with ABA aircraft.

● Air talks between the *Brazilian and Argentine civil aviation authorities* are to establish a legal basis for a FAMA service from Buénos Aires to New York via Brazil. Proving flights over the new route can only take place when Brazilian transit rights have been granted.

FIRST FLIGHTS

● *The motorless version of the SO M1* experimental aircraft constructed by SNCA du Sud-Ouest was taken into the air for the first time on April 6th on the back of a Heinkel He 574 four-engined aircraft.

● The SO M1 is to be used for preliminary studies in connection with the development of the SO 4000 twin-jet bomber. A second version of the SO M1, powered by a Rolls-Royce "Derwent V" turbojet, is designated SO M2 and is expected to start its flight tests in June, 1948.

NEW AIRCRAFT

● The prototype of the *Douglas XF3D-1* twin-jet fighter has been completed and is to start its initial test flights shortly. Developed under a U.S. Navy contract, the XF3D-1 is powered by two Westinghouse 24C turbojets of 3,000 lbs. static thrust.

Grumman XTB3F—1

● The *Grumman AF-1* is a modified version of the Grumman XTB3F-1 torpedo bomber. It seems that the XTB3F-1 is not to go into production, but the AF-1 will probably go into production in the autumn of 1948. The XTB3F-1 is powered by a Pratt & Whitney "Double Wasp" air-cooled 18-cylinder twin-row radial of 2,100 H.P., and by a Westinghouse 24C turbojet of 3,000 lbs. static thrust.

● The *Gloster E.1/44 "Ace"* single-jet research aircraft has made its initial test flight. An all-metal mid-wing monoplane, it is powered by a Rolls-Royce "Nene" turbojet installed in the centre fuselage aft of the cockpit. Span, 36 ft. ; length, 38 ft. ; height, 11 ft.8 in. ; wing area, 254 sq. ft.

● S.A. des Ateliers d'Aviation Louis Bréguet is building the prototype of a carrier-borne jet fighter, the *Bréguet 960*. It is to be powered by an airscrew-turbine of French design, and by a Rolls-Royce "Nene" turbojet.

● Letnany, the nationalised Czech aircraft manufacturing concern, announces a twin-engined twelve-passenger airliner, the *L 250*. It is to be powered by two Argus As 410 air-cooled 12-cylinder in-line engines of 450 H.P. Another nationalised plant, Vysocany, is planning to build two developments of its Aero 45 twin-engined personal aircraft. Both are to be equipped with tricycle landing gear and will be designated *Aero 145* and *Aero 245*.

● Aero Design and Engineering Corp., of Culver City, Cal., has developed a twin-engined light transport aircraft, the *Aero Design "Commander."* It is an all-metal high-wing monoplane accommodating five to seven occupants and powered by two Lycoming air-cooled flat-sixes of 190 H.P. ; these may be replaced by two similar Lycoming engines of 250 H.P. when available. Span, 43 ft. 10 in. ; length, 32 ft. 6 in. ; wing area, 240 sq. ft. ; gross weight, 4,200-4,800 lbs.

Aero Design "Commander"

● The Swiss Federal aircraft factory at Emmen, Lucerne, has completed an all-wing type experimental glider, designated *N-20*, as part of its development work on a high-speed experimental aircraft. The glider is of wooden construction and accommodates one or two occupants. The wing, spanning 24 ft. 10 in., has pronounced sweepback. The empennage consists of a rearwards-inclined vertical tail. The undercarriage is of tricycle design. Test flights, with the N-20 towed by a C.36 multi-purpose military aircraft, are taking place under the supervision of Major Läderach, Chief Test Pilot of the War Technical Division. The glider is towed to the requisite height and then released. The free flight trials are mainly to determine the behaviour of this type of design in flight, in order to secure data for the construction of a larger, powered version.

N-20 experimental glider

INDUSTRY

● *Instituto Aerotécnico de Cordoba* has started to build *Rolls-Royce "Derwent"* torbojets under licence. The conclusion of a licence agreement with the Argentine Government was made known by Rolls-Royce, Ltd., on April 19th.

RESEARCH

● Texas A & M College has appointed *Fred E. Weick*, designer of the ERCO "Ercoupe" two-control personal aircraft, Distinguished Professor and Research Engineer. He will head the *Personal Aircraft Research Centre* which is being established in the College's Department of Aeronautical Engineering.

INTERNATIONAL ORGANISATIONS

● The formation of an *International Federation of Air Line Pilots' Associations* was decided at the International Conference of Pilots' Associations in London at the beginning of April.

AIR TRANSPORTATION

● The Swedish ABA signed a contract for the purchase of ten *SAAB "Scandia"* twin-engined airliners on April 20th. The delivery of the ten aircraft, pressurised-cabin versions of the "Scandia 90-A2," is to start in August, 1949. The placing of the order, stated to be valued at 12,000,000 crowns, comes after extensive trials with the "Scandia" prototype by ABA, which all along has put the whole of its technical and commercial experience at the disposal of the manufacturers in the design and development of the aircraft.

● The ten *Douglas DC-6's for the Swedish ABA* are being ferried by Swedish crews to Stockholm in May. The first aircraft is expected to arrive on May 11th and the remainder at intervals of a few days. The ten DC-6's cost ABA 20,000,000 crowns.

● *Ceskoslovenske Aerolinie (CSA)*, the nationalised Czech airline, may obtain four-engined transports from the Soviet Union, following the breakdown of negotiations with Lockheed Aircraft and KLM Royal Dutch Airlines for the purchase or lease of three "Constellations." These talks were suspended in March as a result of political events in Prague.

● No change is contemplated in the *British Government's policy* that the British airline Corporations should continue to use "interim" type aircraft until such types as the de Havilland "Comet" and Bristol M.R.E. airliners are available. This was stated by G.S. Lindgren, Parliamentary Secretary to the Ministry of Civil Aviation, in the House of Commons on April 14th. He was replying to a question by a Socialist member, claiming that if the present policy were continued, the three Corporations would lose between £7,000,000 and £8,000,000 annually.

* Excerpts from Nos. 1447-1463 (April 8th to May 5th, 1948) of "Interavia, International Correspondence on Aviation," an illustrated newsletter published three times a week in four separate language editions, English, French, Spanish and German.

● The *personnel of KLM Royal Dutch Airlines* now totals 12,000, including 332 pilots, 228 radio operators, 152 flight engineers and 195 stewards and stewardesses. KLM expects to receive its twelve "Convair-Liners" between June and September.

● The Belgian *Sabena* has re-opened its pre-war *Brussels-Frankfurt* service. It is operated twice weekly with Douglas DC-3's.

● *Avio Linee Italiane* started operating international services with the inauguration of Paris—Milan and Milan—Brussels services. Three-engined Fiat G. 212 aircraft are used.

● The Swedish Board of Civil Aviation has authorised *ABA* to operate two services from Stockholm to Teheran (one via Lydda and the other via Istanbul—Ankara).

● *KLM* will shortly open a weekly Amsterdam—Cairo—Basra—Karachi—Calcutta—Bangkok—Shanghai service, under the terms of the Dutch-Chinese air agreement.

● *Air-India International* is carrying out three Bombay—Cairo—Geneva—London proving flights before starting scheduled services in June. The service will be weekly initially, and will subsequently be intensified to two, three and finally four round flights weekly. Three Lockheed 749 ("Gold Plate") "Constellations" are being used over this route.

● ATLANTIC : *In the month of April Air France made 80 scheduled trans-Atlantic crossings.* The Paris—New York route was operated seven times weekly, the Paris—Buenos Aires route twice weekly and the Biscarosse—Fort de France (Martinique) route fortnightly. Following the intensification of the North Atlantic service to eleven round flights weekly, Air France aircraft will make over 100 Atlantic crossings monthly.

● The "Comète-d'Or," an Air France Lockheed 749 "Constellation," made the first non-stop commercial flight from Paris to New York on April 27th. It flew the trip in 16 hrs. 22 min.

● BOAC co-ordinated its London—New York and New York—Bermuda services on April 25th, so as to provide a through service from London to Bermuda with only a short stop-over in New York. BSAA operates from London to Bermuda on its route to the Caribbean.

● *British South American Airways* has decided to use flight refuelling for its freight services (Bermuda, Azores, etc.). The company co-operated in test carried by *Flight Refuelling, Ltd.,* in 1947. Flight Refuelling will undertake the airborne tanking of the BSAA freight services.

● The projected *Irish trans-Atlantic service* has been abandoned by the order of the Irish Government on the grounds of expense. The announcement from Dublin on April 19th confirms earlier reports that the postponed service was not to be inaugurated.

● *Scandinavian Airlines System* plans to intensify its North Atlantic service to ten round flights weekly, following the delivery of all of its seventeen Douglas DC-6's in July. On October 1st, it is likely that DC-4's will be withdrawn from intercontinental services and exclusively used on SAS European routes.

● The Anglo-Italian *Alitalia* carried out a second flight to *South America* on April 28th. Until regular services over the Rome—Dakar—Natal—Rio de Janeiro—Buenos Aires route are started at the end of May, further proving flights with mail and freight are to be carried out.

● *KLM* plans to extend its South American service from Montevideo to Santiago di Chile in June.

● *Compania Cubana de Aviacion,* the Cuban associate of PAA, was considering opening a Havana—Bermuda—Azores—Lisbon—Madrid route with Douglas DC-4's at the end of April or the beginning of May.

● *Panair do Brasil,* PAA's Brazilian associate, completed its second year of services to Europe without accident on April 10th. Lockheed "Constellations" and Douglas DC-4's have made some 600 Atlantic flights, transporting some 7,000 passengers in 1946 and over 17,000 in 1947. Freight traffic increased almost four-fold. Following the recent extension of its service from Paris to Frankfurt, Panair plans a further estension to Berlin, and also the incorporation of Madrid and Brussels on its route network.

● The CAB has now set *minimum air cargo rates,* after all applications for rate changes had been frozen since October, 1947. The CAB order establishes a standard rate for scheduled and non-scheduled airlines of 16 cents per ton-mile, for the first thousand ton-miles, in any shipment, and 13 cents for all excess ton-miles in a single shipment. This brings to an end the rate war under which the level of air freight charges would have been reduced to less than 13 cents per ton-mile.

● The scheduled airline industry of the United States is now able to make available 632 per cent. of the emergency carrying capacity it offered at the beginning of World War II. The current fleet comprises 970 aircraft, against 340 in 1941. The present emergency military transport potential is 255 million ton-miles monthly, based on a 100 per cent. load factor and a 25 per cent. increase in aircraft utilisation, compared with 34 million ton-miles monthly in 1941.

AIRLINE PERSONALITIES

● LaMotte T. Cohu, President of Trans World Airline since 1947 and TWA Director since 1934, will resign as President on June 1st, 1948. The reason for this step, given by Cohu himself, is that he has achieved the purpose of his office.

SERVICE AVIATION

● Argentina received military aircraft valued at £20,000,000, including 100 jet fighters (presumably Gloster "Meteor IV's") in 1947, according to reports from London.

● All interceptor fighter squadrons of R.A.F. Fighter Command will shortly be equipped with Gloster "Meteor IV" twin-jet fighters.

● The Royal Auxiliary Air Force is now being equipped with jet aircraft. All squadrons, except those in the London area, will receive de Havilland "Vampires."

● *All-weather flying research* is to be expanded by the R.A.F., following the establishment of an Assistant Directorate of Training (All-Weather Flying) at the Air Ministry and an All-Weather Research Squadron as an integral part of the Empire Flying Training School, at Hullavington, Wilts.

● Unofficial British sources have confirmed Russian reports concerning the construction of an important air base on the island of Cyprus.

MILITARY PERSONALITIES

● *Lieutenant-General Claudio Trezzani,* of the Italian Army, formerly Head of the General Staff of the Italian Armed Forces, was appointed Chief of the General Staff of the Italian Land, Sea and Air Forces on April 21st.

PRIVATE FLYING

● *Lieutenant-Commander Harold Perrin,* internationally-known as the Founder-Secretary of the Royal Aero Club, died suddenly on April 9th, at the age of seventy. He became Secretary of the Aero Club of the United Kingdom (renamed the Royal Aero Club in 1910) and remained in this position until he retired in 1945. In addition to innumerable other events, he organised five of the Schneider Trophy contests. Moreover, he observed all British attempts on speed, distance and height records on behalf of the F.A.I.

● For the first time foreign civilian entrants and foreign aircraft will be accepted for the Bendix Trophy trans-Continental race to be held on September 4th, during the 1948 National Air Races, at Cleveland, Ohio.

Nord 1200 "Norécrin" three-seater, in Rome

● A group of twenty-one Nord 1200 "Norécrin" three-seater personal aircraft made a flight round the Mediterranean at Easter, during which a distance of 5,000 miles was covered ; thus the 21 aircraft flew a combined total of 105,000 miles. The flight went by way of Paris—Nice—Rome—Naples—Palermo—Tunis—Bone—Algiers—Oran—Oudja—Meknes—Rabat—Marrakesch—Agadir—Casablanca—Tangiers—Lisbon—Oporto—Madrid—Biarritz—Tours—Toussus-le-Noble. All the aircraft were flown by their owners, who carried out the flight without incident.

INDUSTRIAL PERSONALITIES

● *Charles Hart Miller* has been appointed Vice-President (Sales) by The Glenn L. Martin Co. Miller was Executive Vice-President and Managing Director of Republic Aviation between 1945 and 1947.

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Frutiger Söhne & Cie **Thun**

Contracts executed :

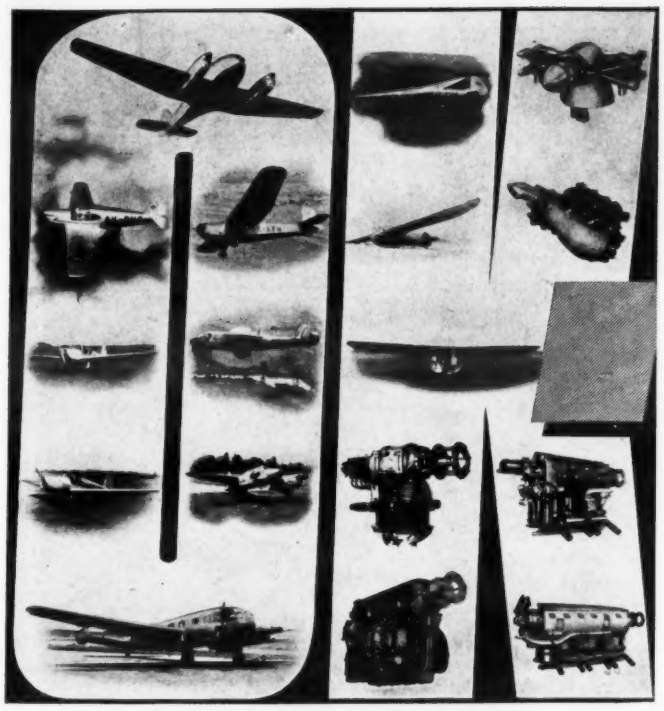
Subbase work for west runway, lot I
Instrument runway, lot I
Instrument runway, lot III
North taxiway
Altbach canalisation, lots III and IV

Building concern II
Kloten Airport

A.G. Heinr. Hatt-Haller, Zürich
H. Gossweiler & Cie., Zürich
Losinger & Co. A.G., Zürich
Stuag A.G., Zürich

Contracts executed :

West runway, lot II
Instrument runway, lot IV
Apron and taxiways
North-wind runway, lot IV
Workshop and hangar parking areas
Reinforced concrete structure of workshop



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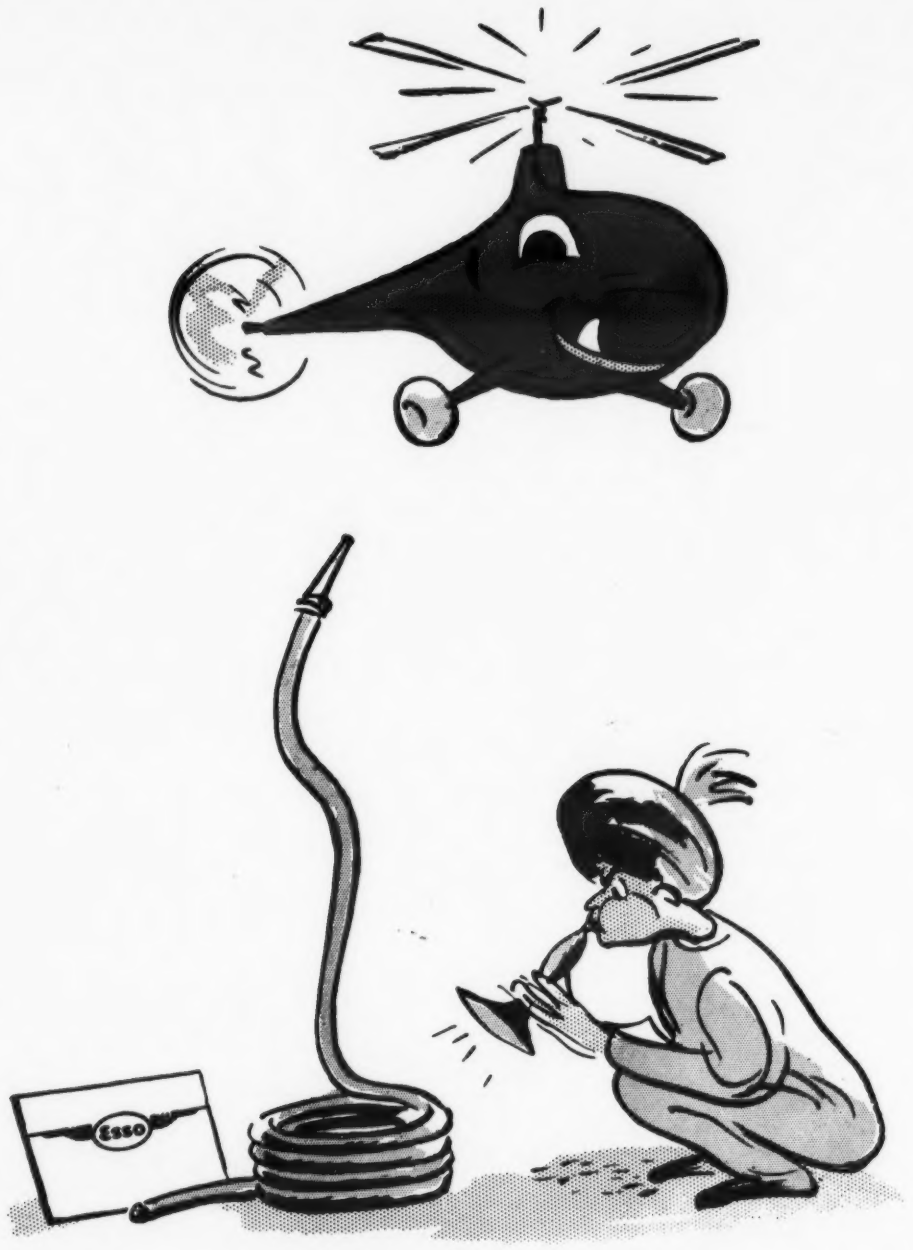

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